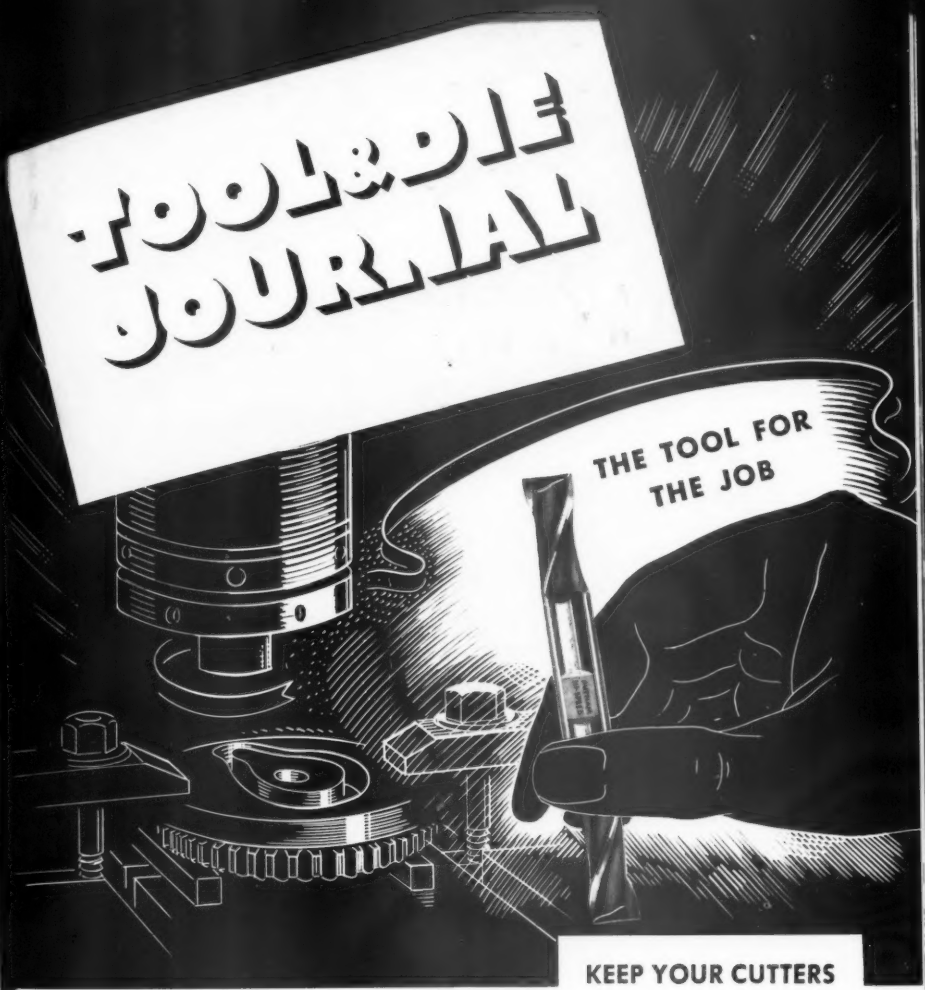


A Putnam Hi-Speed End Mill

always provides maximum speed in cutting, making possible exceptional finishes with the milling operation alone. Putnam End Mills, on any job, can be depended upon for minimum breakage—a guarantee of full production efficiency in milling.

KEEP YOUR CUTTERS

Sharp

Check the sharpness of your cutting tools regularly. Don't continue to run them after they have become dull. Dull tools soon become broken tools.

"For High Achievement"

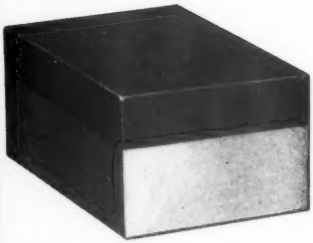
ARMY (E) NAVY

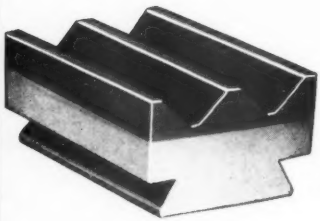
AWARDED AUG. 15, 1942

PUTNAM TOOL COMPANY

2985 Charlevoix Avenue • Detroit, Michigan

NEW WAY TO CONSERVE HIGH SPEED STEEL





Special Bulletin contains full particulars and prices. Write for your copy of Bulletin TN today.

Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks *(high speed steel cutting face; mild steel base)* **save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—**

1. **Non-hardenable, tough base minimizes tendency to crack and break out at sharp dovetail corners and screw holes during heat treating or when working.**

2. **Easier to drill and tap screw holes and machine dovetails in mild steel base; this work may be done** *after* **hardening if desired.**

3. **More prompt delivery because of reduced amount of high speed steel.**

4. **Inseparable bond between cutting face and base assured by special technique of electric welding.**

5. ***Marked saving of strategically important tungsten.***

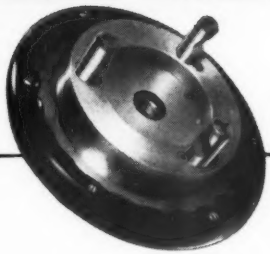
QUALITY SERVICE

THE FORGING and CASTING CORPORATION

FERNDALE (DETROIT) MICHIGAN

HARDINGE SJOGREN

SPEED COLLET CHUCKS



For CAM-LOCK SPINDLES

For TAPERED KEY-DRIVE SPINDLES

For THREADED NOSE SPINDLES

Are you getting full value from your investment in tool-room and engine lathes?

A Hardinge-Sjogren Speed Collet Chuck gives greater capacity, saves time, increases accuracy and assures better results.

It is readily adapted for use on the spindle nose of your lathes, takes precision collets — enabling the operator to do better work . . . faster!

Available in three sizes: 1", 1-3/8" and 1-3/4" capacity.

Furnished with Hardinge Precision Collets.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR

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ELMIRA, N.Y.

THE TOOL & DIE JOURNAL

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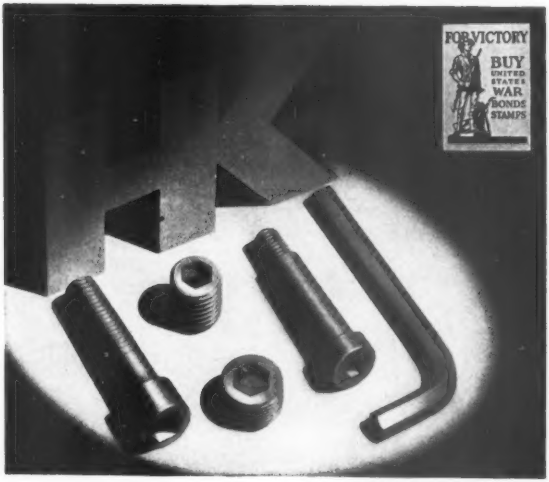
Acceptance under the Act of June 5, 1934, authorized October 22, 1942

GUARANTEED *Unfailing* PERFORMANCE



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HOLO-KROME FIBRO FORGED Socket Screws are guaranteed by Holo-Krome to give Unfailing Performance—the kind of performance demanded today on every front line of Industrial War Production.

Unfailing Performance is Guaranteed by Holo-Krome because of the superior method patented and exclusively used by Holo-Krome in the production of these PRECISION MADE SCREWS.

WRITE FOR CATALOG OF SOCKET SCREW STANDARDS

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THE HOLO-KROME SCREW CORP. HARTFORD, CONN., U. S. A.

...and pass the
Ammunition

OUR job is to make sure that there *is* a never-ending flow of ammunition *to pass* because we manufacture the tools that make the small arms ammunition . . . without which our fighting forces would be helpless.

Hair-splitting accuracy and diamond-like hardness, achieved by specialized equipment and methods—all geared to a split-second time table—are the primary specifications of the tools and dies required to produce a continuous flow of small arms ammunition to war fronts in every quarter of the globe. Every facility we possess is devoted to supplying the men behind the men behind the guns.

OHIO TOOL COMPANY

CLEVELAND • OHIO

Manufacturers of Small Arms Ammunition Tools

DESIGNERS AND BUILDERS OF TOOLS • DIES • JIGS
FIXTURES • GAGES AND SPECIAL MACHINERY

Courtesy North American Aviation, Inc.

DEATH MASKS LOOK ON AS AIRCRAFT WELDERS AND DE-STA-CO TOGGLE CLAMPS SPELL DOOM FOR THE AXIS

You have probably seen this picture before—in a recent issue of *Life* and in other national publications. The picture was taken at the Dallas division of North American Aviation, Inc., and of it *Life* said:

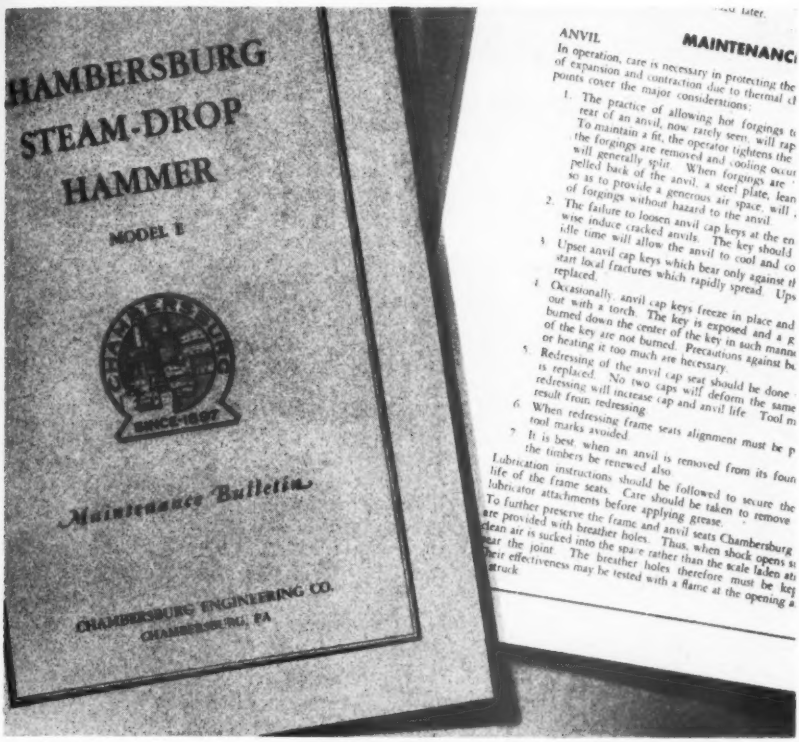
"Welders at North American Aviation Company's plant here have injected a note of grim reality into their task by wearing death masks while molding death weapons for the Axis. They are actually ordinary protective hoods painted with grimacing Hitler, Hirohito and Mussolini faces. The violence they reflect in the light of flickering torches makes one realize the intensity with which the war is being waged right here at home."

Silently doing their part in this dramatic picture of wartime production are De-Sta-Co Toggle Clamps. They can be clearly seen, holding the tube structure of a North American Aviation, Inc., plane in rigid position, while the grim welders skillfully do their part in spelling doom for the Axis.

In America's leading aircraft plants as well as throughout all war industry, De-Sta-Co Clamps are used on both simple and complicated fixtures. Because only a slight movement of the handle is required, a De-Sta-Co Toggle Clamp securely clamps a part under pressure. Workers do their jobs faster, more efficiently . . . whether the job is welding, drilling, reaming, milling, soldering, machining, checking, or assembly operations.

Learn how De-Sta-Co Toggle Clamps will help on your job. The complete De-Sta-Co line is illustrated and described in Bulletin No. 43. Write for it.

DETROIT STAMPING CO.
Established Over 25 Years
344 Midland Ave • Detroit, Mich.


HAMBERSBURG
STEAM-DROP
HAMMER
MODEL E
SINCE 1892
Maintenance Bulletin
CHAMBERSBURG ENGINEERING CO.
CHAMBERSBURG, PA
later.
ANVIL
MAINTENANC
In operation, care is necessary in protecting the
of expansion and contraction due to thermal ch
points cover the major considerations:
1. The practice of allowing hot forgings t
rear of an anvil, now rarely seen, will rap
To maintain a fit, the operator tightens the
the forgings are removed and cooling occur
will generally split. When forgings are
pelled back of the anvil, a steel plate, lean
so as to provide a generous air space, will
of forgings without hazard to the anvil.
2. The failure to loosen anvil cap keys at the en
wise induce cracked anvils. The key should
idle time will allow the anvil to cool and co
3. Upset anvil cap keys which bear only against th
start local fractures which rapidly spread. Ups
replaced.
4. Occasionally, anvil cap keys freeze in place and
out with a torch. The key is exposed and a g
burned down the center of the key in such manne
of the key are not burned. Precautions against bu
or heating it too much are necessary.
5. Redressing of the anvil cap seat should be done
is replaced. No two caps will deform the same
redressing will increase cap and anvil life. Tool m
result from redressing.
6. When redressing frame seats alignment must be p
tool marks avoided.
7. It is best when an anvil is removed from its foun
the timbers be renewed also.
Lubrication instructions should be followed to secure the
life of the frame seats. Care should be taken to remove
lubricator attachments before applying grease.
To further preserve the frame and anvil seats Chambersburg
are provided with breather holes. Thus, when shock opens s
clean air is sucked into the space rather than the scale laden at
wear the joint. The breather holes therefore must be kep
their effectiveness may be tested with a flame at the opening a
struck

Chambersburg 35,000 lb. Model "E" Steam Drop Hammer

GET THE MOST OUT OF YOUR HAMMERS

DROP FORGINGS are more essential today than ever before. Millions of forgings per year are needed for the aircraft program alone. Production of hammers at Chambersburg is at an all time high . . .Yet more are needed. Older hammers must therefore do more than ever . . . must last longer. There are many ways to get more out of your hammers . . . perhaps you can get some new ideas out of our Model "E" Steam Drop Hammer Maintenance Book . . . Write for a copy . . . even if your hammers are *not* Chambersburgs.

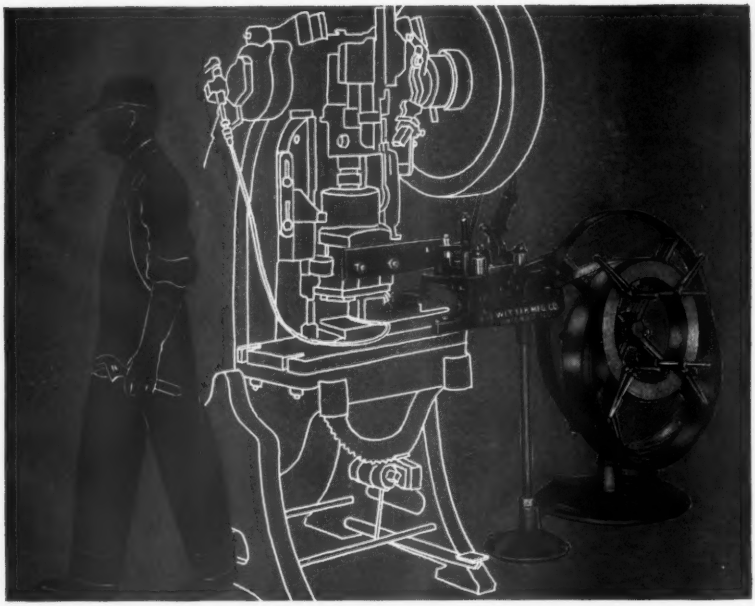
CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

CHAMBERSBURG
HAMMERS · CECOSTAMPS · PRESSES

WAR PRODUCTION *rolls out faster with*

WITTEK *Automatic*

ROLL FEEDS AND REEL STANDS



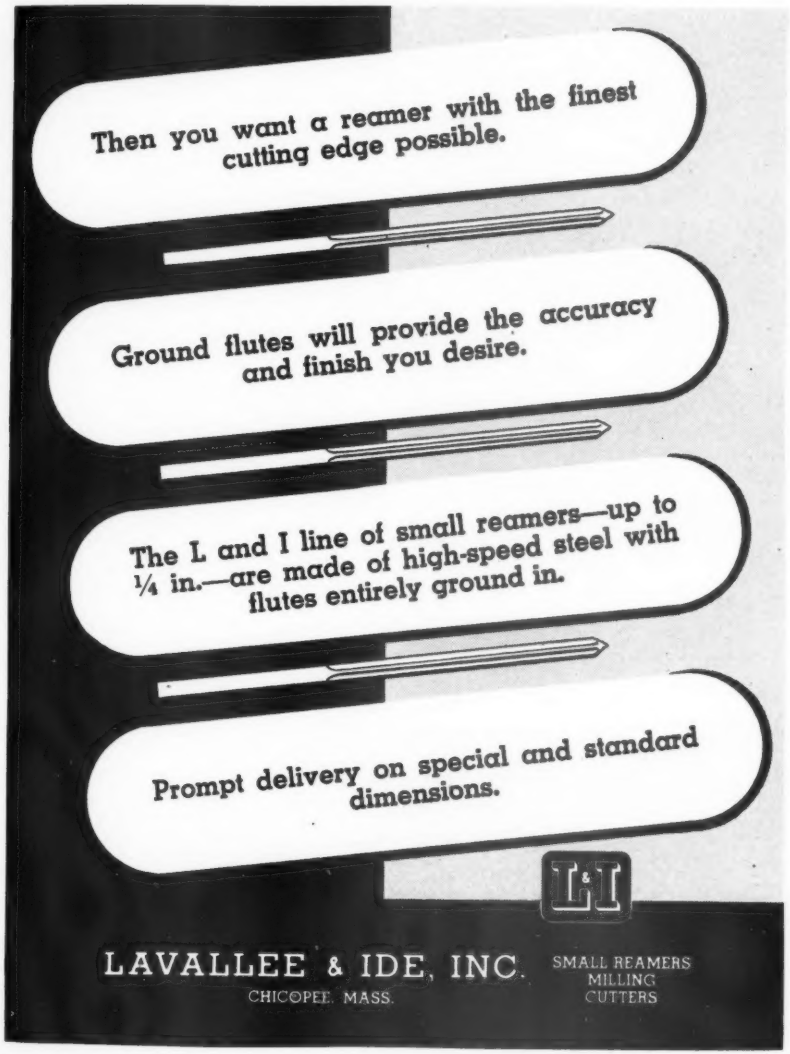
The major problem confronting industry today is increased war production. Manufacturers of metal stampings must recognize automatic feeding of coiled strip stock to punch presses as vital to the solution of their problem.

Wittek Automatic Roll Feeds and Reel Stands are designed and built by engineers with years of experience to guide them. With Wittek you can conserve man-hours and maintain new high production schedules.

★ *Write for Descriptive Catalog*

WITTEK MANUFACTURING CO., 4305-15 W. 24th Pl., Chicago, Ill.

Are You Finishing Small Holes To Decimal Tolerances?


Then you want a reamer with the finest cutting edge possible.
Ground flutes will provide the accuracy and finish you desire.
The L and I line of small reamers—up to ¼ in.—are made of high-speed steel with flutes entirely ground in.
Prompt delivery on special and standard dimensions.
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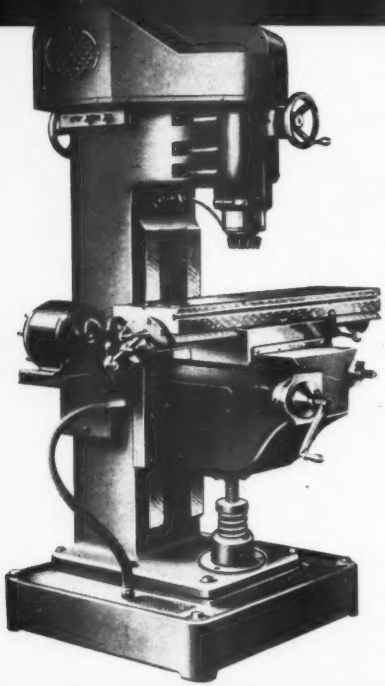
LAVALLEE & IDE, INC.
CHICOPEE, MASS.
SMALL REAMERS
MILLING CUTTERS

ANOTHER BOOST FOR VICTORY!



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Precision Built-Heavy Duty

VERTICAL MILLER

Drive: 1½ H. P. Motor; V-Belt, Worm and Worm Gear.

12 Speeds; 9"x 39" Table.

Travels: 14" vertical, 10" cross, 23" longitudinal; 4" vertical spindle.

Weight: 2400 pounds.

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MACHINE & TOOL COMPANY

• SALES DIVISION •

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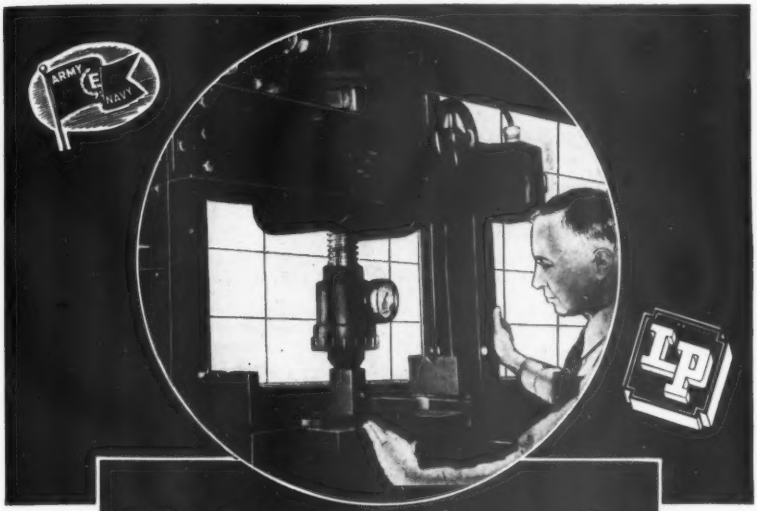
U. S. A.



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THAT PUTS PRESSUREMATIC

POWER PRESSES TO WORK . . .

. . . forming dies for .30, .45, .50 calibre bullets . . . press-fitting parts for tanks, planes, munitions . . . duplicating work pressures on die try-outs . . . straightening and bending—and doing many other jobs no one thought of until the war *made us think!*

Solenoid controls stop ram automatically at any pre-selected pressure—or back ram off work! Fast-acting, too—from 0 to 60 tons in 4 seconds! Movable head; adjustable bolster; foot-pedal controls leave operators hands free. Re-set switch and thermal relays protect motor from overload.

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IMMEDIATE DELIVERY!

SEE ONE WORK—MAIL THIS COUPON

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PRODUCTS INC.

BEDFORD · OHIO · U·S·A

ESTABLISHED 1919

Lempco, Dept. TD, Bedford, Ohio

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ADDRESS .....

CITY .....STATE.....

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Planning ahead for tomorrow—just as we did yesterday for today—has developed a loyal organization of skilled men—thorough methods of supervision in all phases of machining and tooling—and equipment that is meeting war production precision needs 24 hours a day. If we can help your production problems—write, wire or phone.

C. M. SMILLIE & CO.

1108 WOODWARD HGTS., FERNDALE, MICH.

PRECISION • YESTERDAY • TODAY • TOMORROW

ALL THE EQUIPMENT FOR *PRECISION* PARTS

GRINDING

Internal	7
External	5
Surface	4
Rotary	3
Centerless	1
Honing	2

★

MACHINING

Turret Lathes	28
Horizontal Mills	3
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Hand Mills	4
Lathes	3
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Broaching	1

INSPECTION

Rockwell	2
Comparater	3
Shadowgraph	1
Gage Blocks	6 sets
Plugs - Thread Gages	
Micrometers	

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TOOLS AND FIXTURES

TOLERANCE CONTROL

The quality of any precision built product is determined by its tolerance. The higher the quality, the more rigid the "tolerance control." Continuous, close and critical inspection is a vital requirement in providing this control and Bunell men—from designers to skilled craftsmen—are experienced in meeting the most rigorous specifications.

Precision gage blocks, comparators, index masters, working gages of every description including gages of our own design are used to make dimensional checks and all steels must pass our hardness tests.

THE BUNELL MACHINE & TOOL COMPANY

1601 East 23rd Street, CHerry 0343, Cleveland, Ohio

We do not make Electronic Tubes

but—

WE ARE HELPING TO MAKE THEM BY NOT USING TANTALUM

TANTALUM is an essential element in the electronic tubes used in planes, tanks, ships, "subs," listening devices, "walkie-talkies," and wherever radio or sound equipment or "electric eyes" are used. We are urged to save Tantalum as a scarce, allocated metal on the "most critical" list.

FIRTHITE RESEARCH has enabled us to produce a steel-cutting sintered carbide of superior quality in which Tantalum is **unnecessary.** FIRTHITE Engineers are prepared to demonstrate the Tungsten-Titanium type which:

(1) Is made from domestic alloys;
(2) Is cheaper than the Tantalum types;
(3) Steps up production of steel products;
(4) Releases Tantalum for more essential uses.

May we prove the value of the Tungsten-Titanium type to you?

Firth-Sterling

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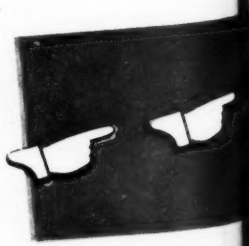

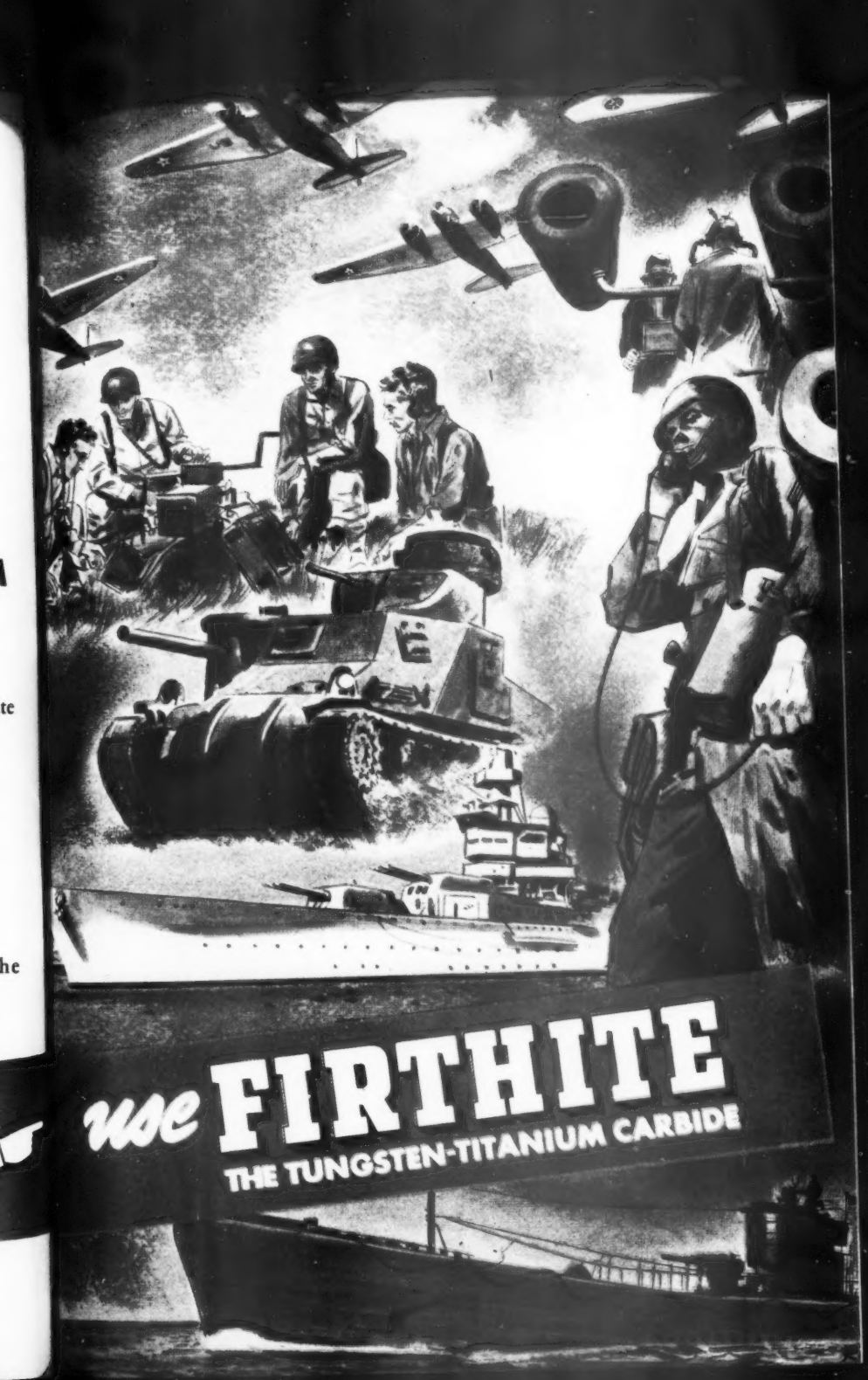
use FIRTHITE
THE TUNGSTEN-TITANIUM CARBIDE

CINCINNATI

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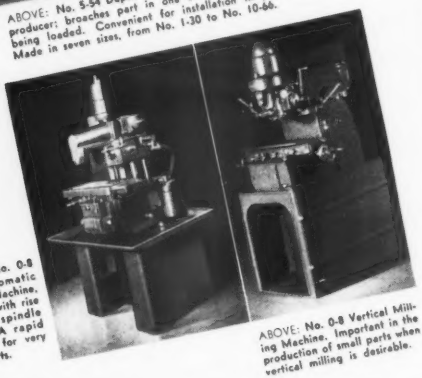
FOR RAPID PRODUCTION

PRODUCTION of parts for war materiel and essential civilian items can be often speeded up by replacing old shop equipment with new machines, with automatic machines, by employing more intensive tooling, new production methods. Perhaps in your own shop you can find many such opportunities for increasing production per unit of man power and factory space. In the fields of milling, grinding, broaching, lapping, die sinking, and cutter sharpening, look to CINCINNATI for more efficient machine tools and more dependable Engineering Service.

ABOVE: No. 5-54 Duplex Hydro-Broach Machine. A continuous producer; broaches part in one station while other station is being loaded. Convenient for installation in production line. Made in seven sizes, from No. 1-30 to No. 10-66.

ABOVE: 12" Hydraulic Universal Grinding Machine. Raises tool room and job shop grinding to a new level of accuracy and production. Made in 24", 36", 48", and 72" lengths.



RIGHT: No. 0-8 Plain Automatic Milling Machine, equipped with rise and fall spindle carrier. A rapid producer for very small parts.

ABOVE: No. 0-8 Vertical Milling Machine. Important in the production of small parts when vertical milling is desirable.

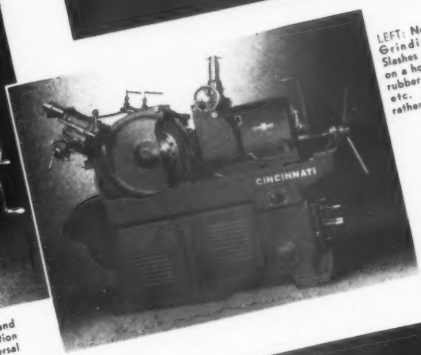
ABOVE: No. 1-18 Plain Automatic Milling Machine. For shops where high production of small parts is an important factor.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING MACH

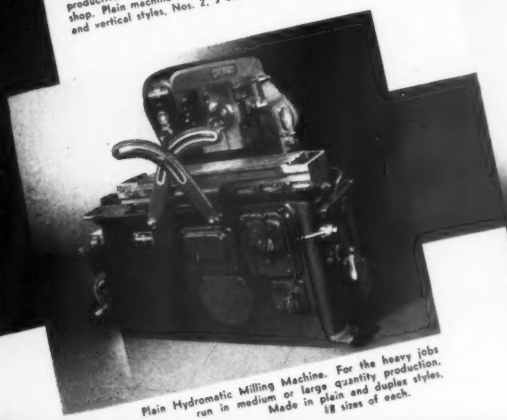
OF War Materiel

WITH AN EYE TO LOW COSTS

ABOVE: Dial Type Milling Machine. Accurate and productive millers for the tool room and production shop. Plain machine illustrated. Also built in universal and vertical styles. Nos. 2, 3 and 4 size.



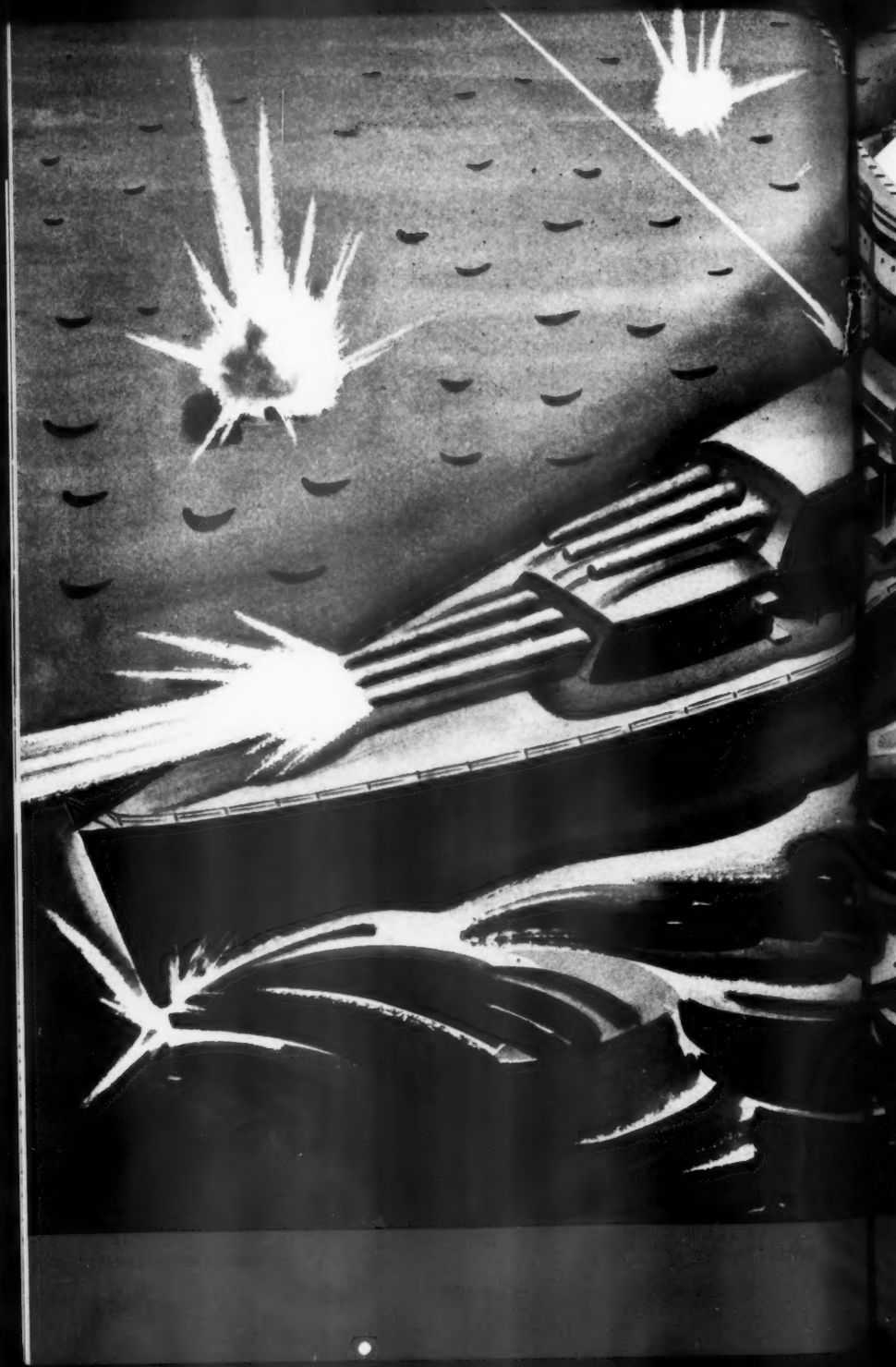
LEFT: No. 2 Centerless Grinding Machine. Slashes grinding costs on a host of parts; steel, rubber, plastics, glass, etc. Economical for rather small lots, too.



Plain Hydromatic Milling Machine. For the heavy jobs run in medium or large quantity production. Made in plain and duplex styles. All sizes of each.

No. 2-24 Plain Automatic Milling Machine with Hydraulic Rise and Fall Mechanism for the Spindle Carrier.

MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES



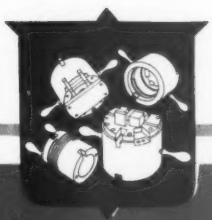
A TRIBUTE TO PRECISION

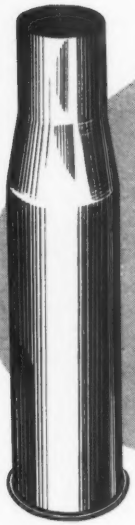
The Jean Bart, pride of the French Navy, can attest to the precision of American Built guns. The two shells which sank the Jean Bart were fired from an American battleship 20 miles away. The precision necessary for such marksmanship was only possible through the use of gages built by skilled craftsmen.

Our experienced gagemakers are contributing in large measures to the perfection of the Allied Nation's fighting equipment. We will continue to serve the era of peace—as we did before—an era when precision will turn today's dreams into tomorrow's realities.

TOOLS & GAGES, INC

3112 EAST 63RD STREET • CLEVELAND, OHIO





SPEEDING *Steel Shell Production*

Gilron compounds are now doing a real job drawing steel cartridge and shell cases. Aiding in the development work, Gilron engineers have been instrumental in increasing production for leading manufacturers.

20 mm to 105 mm steel shell cases can be produced with the new water soluble non-toxic coating compound, thus eliminating copper plating.

Because of the high film strength, Gilron coating fluid, **completely eliminates scratching** and **scoring.**

A convincing list of satisfied users will be furnished on request, together with complete production details.

Gilron

PRODUCTS CO., INC.

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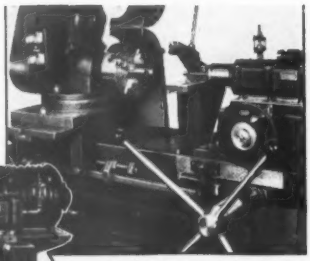
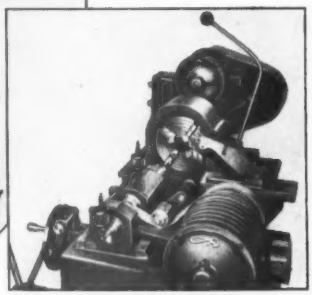


Angle view, work in chuck. Headstock graduated through 180 degree.

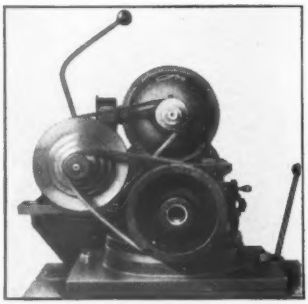


Looking down, from grinder head end.

Saw-way MULTI-PURPOSE INTERNAL GRINDER

Grinds holes ¼ to 18″ diameter . . holes up to 9″ deep, straight or tapered. Will handle a wider range of work than has heretofore been possible on any one model machine . . sturdily constructed throughout . . complete specifications, delivery and price on request.

Representatives throughout the U. S. A.



View from headstock end, guard removed, showing step pulleys providing various speeds of work head. Headstock may be slid crosswise any distance up to 6″.

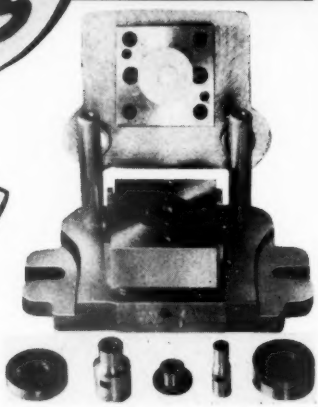
Saw-way INDUSTRIES

★ Machine Tool Division ★

4877 EAST EIGHT MILE · DETROIT, MICHIGAN

Economy Demands THIS MODERN METHOD OF MAKING WASHERS

HOVIS
UNIVERSAL MASTER
WASHER DIES



MADE IN FOUR SIZES:
¾" . . 1½" . . 2½" . . 4"

NO LONGER —
is it necessary to waste precious metals

In fact, the advantages of making washers the HOVIS WAY are so great that you can't afford to continue with the old-fashioned expensive and wasteful method. For instance, consider the old way: In order to produce one washer, a compound die is required using approximately 45 POUNDS OF CRITICAL STEEL. . . . Then, to make the same washer by the advanced HOVIS METHOD, you use one set of interchangeable parts for a ¾" Hovis Washer Die, in this way consuming only 3 LBS. OF STEEL. What a tremendous saving! That's the reason industries are so quick to take advantage of this revolutionary, practical method.

Write for Illustrated Folder

Save Steel, Storage Space and Cataloging. Cut Down Your Inventories.

HOVIS
SCREWLOCK CO.
8100 E. Nine Mile Road
Van Dyke Michigan
Suburb of Detroit Phone Centerline 1515

OWI Photo by Hollem

NOW YOU MUST LEARN *"HOW-TO-DO-IT"* BETTER..CHEAPER..WITHOUT WASTE

CAN YOU USE HELP?

We have available a new motion picture and a booklet (soon off the press), both on "*Stainless Steel Welding.*" Also for your production men, a complete "*Handbook of Special Steels.*" For your engineers, certified "*Blue Sheets*" on each tool and stainless grade. For your apprentice or training courses, "*Elementary Discussions on Tool and Stainless Steels.*"

● Write for the informational help you need, or for the assistance of our Technical Staff.

Address Dept. TD

PRODUCING constantly improved war goods at a diminishing rate of cost, and an increasing rate of speed, ordinarily wouldn't be much of a trick for America. It's right up our industrial alley.

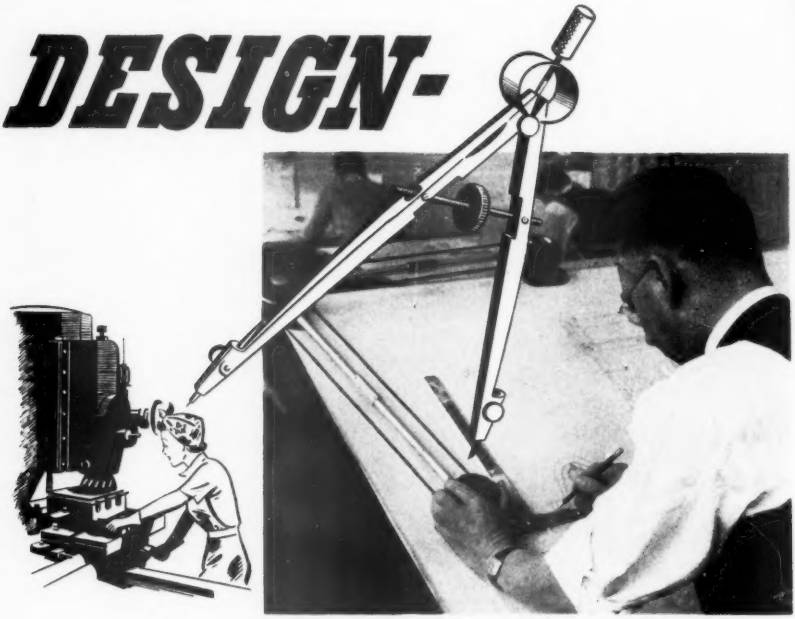
But conditions today are not as usual. There is no inexhaustible ocean of materials. There is, instead, a controlled stream flowing through rigidly restricted channels. We have to do *more,* actually, with *less.*

Thrift is especially essential with the vital steel alloys. If you use alloy steels in *any* form, check your dies, your cutting tools and machine setups, your heat-treat and welding methods—check and recheck every operation to reduce rejects, spoilage, undue scrap, or any other form of waste. Above all, carefully segregate and classify your unavoidable alloy steel scrap (*that is the only way the mills can reclaim it*) and rush it back into the useful cycle.

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-8665-A

DESIGN-



...FOR EFFICIENT MANUFACTURE

In these days of dependable machines and highly developed shop technique, *design* is the all-important factor in every job. Skillful design means fast, economical production.

More than thirty-five years of "know how" have given the McKinney organization the skill and experience to solve your design problems. And because we are tool builders as well as designers and engineers, we have a *practical* approach to your requirements.

Let McKinney help you with those "tough" tooling problems on your war production program. *We invite your inquiries.*

DEPEND UPON MCKINNEY FOR:

- Design and manufacture of dies, jigs, fixtures
- Process Engineering
- Tool Designing
- Plant Layout and Routing
- Product Engineering
- Machine Designing

McKINNEY

TOOL & MANUFACTURING CO.

1688 ARABELLA RD. CLEVELAND, OHIO

Welch

QUICK DEMAGNETIZER

Operates on **220 VOLTAGE** A. C. 60 Cycle

"Another Welch Product"

INSIDE MEASUREMENTS APPROXIMATELY 4"x11"

•

A REMARKABLE TIME SAVER

AN outstanding unit needed wherever magnetic chucks are used. Operates on 220 voltage. Any ordinary sized pieces, such as cutters, gears, washers, etc., can be demagnetized by a single pass through its powerful field. Can be easily connected by your own electrician in any convenient location in your plant. Equipped with convenient switch. (If your power is other than 220 volt, 60 cycle, A.C., kindly let us know.) Carried in stock for immediate delivery. 10 DAYS FREE TRIAL IF DESIRED.

Price $120.00

Write for particulars

Welch **INDUSTRIES, INCORPORATED**

Makers of High Speed Milling Cutters — Form Tools and Special Tools

20000 WEST EIGHT MILE RD. DETROIT, MICHIGAN

Speed alone is not enough in today's grinding.

Accuracy to tolerances heretofore considered impractical is now a "must" and is being maintained on THOMPSON GRINDERS.

The Type C Thompson Grinder above is finish grinding the tops of milling tables for a prominent mid-west machine tool builder.

Thompson Grinders, to meet today's demands, combine unusual speed with ability to work to very close tolerances on a high production basis.

• *Write for descriptive bulletins.* •

THE THOMPSON GRINDER CO.

Completely Covering all Normal Ranges of Surface Grinding Requirements

SPRINGFIELD, OHIO, U. S. A.

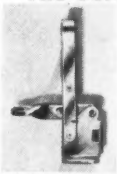
FOR DEFENSE OF AMERICA

. . . . *and Defeat of the Axis*

We at Danly are working for only one purpose today. That purpose is defense of America and defeat of the Axis.

You know us as makers of die sets and diemakers' supplies. As such we are proving our worth, helping you to meet your tooling programs by 3-shift, 24-hour operation of machines guided by men. Other men are guiding other machines in the production of hydraulic, pressure and naval weldments. These men are American men guided by one principle only—

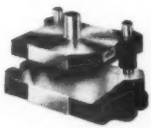
THE DEFENSE OF AMERICA AND THE DEFEAT OF THE AXIS



Danly Kwik-Klamp—Toggle Clamps

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52nd AVENUE
CHICAGO



Precision Die Sets
Commercial Die Sets
Tool · Gage
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Milwaukee, Long Island City, N.Y., Dayton, Detroit, Rochester, Cleveland, Philadelphia
DUCOMMUN METALS & SUPPLY CO. • LOS ANGELES, CAL.

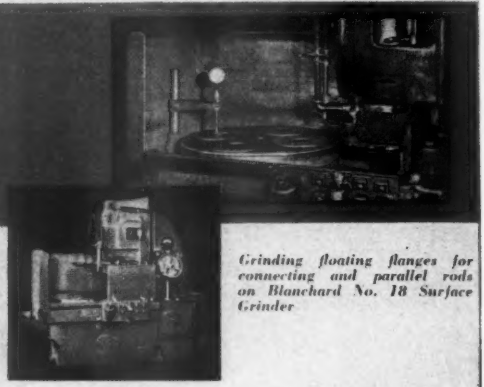
BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
Adaptability
Fixture Saving
Operation Saving
★ Material Saving
Fine Finish
Flatness
Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

"PUT IT ON THE BLANCHARD"



Grinding floating flanges for connecting and parallel rods on Blanchard No. 18 Surface Grinder

THE Blanchard No. 18 Surface Grinder, shown above, is used for odd lot jobs in one of this country's leading railway shops. Other jobs up to 36″ in diameter are also ground on this machine.

The job shown is boiler steel floating flanges for connecting and parallel rods. 1/32″ of stock is removed from both sides to limits of .002″ for flatness. 37 pieces (72 surfaces) are produced per hour.

These odd lots are ground at a profit on the Blanchard No. 18 because the set-ups may be changed quickly—the required limits and finish are easily maintained and held—and maximum production is obtained.

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

The TESTMASTER

REG. U. S. PAT. OFF.

UNIVERSAL

DIAL INDICATOR

with the NEW

INDEX POINT

that locks in place and sets positively

Serrations mesh positively. Interchangeable point locks on pivot. Low friction bearings.

Crown gear reduces friction and inertia – greater accuracy.

Illustrations are actual size

You get more quality features in this new FEDERAL Universal Test Indicator.

The Testmaster is chock full of features that you will appreciate more and more as you use it.

It is accurate. Its point swivels positively, works in either direction and won't come out unless you want it to. The universal clamp and dovetail slides make it handy. Its quality is worth more than the price. Write for circular.

For lining up and testing machine work the Testmaster is exceptional.

FEDERAL PRODUCTS CORPORATION

1144 EDDY STREET PROVIDENCE, R. I.

★ ★ ★ ★ ★ **FEDERAL** ★ ★ ★ ★ ★

PRECISION MEASURING INSTRUMENTS

Chicago • Cleveland • Detroit • Hartford • Los Angeles • Milwaukee • Montreal • Muncie
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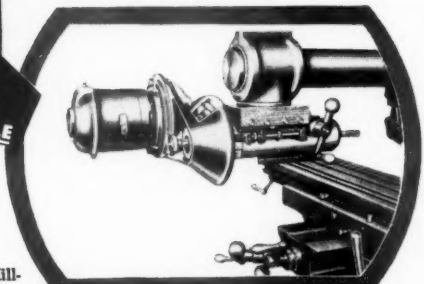
New HALCO UNIVERSAL HEAD

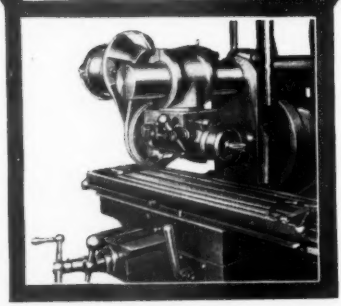
Only Machine Made On This Lathe Principle

for High Speed MILLING, DRILLING, BORING and COUNTER BORING

Five Speeds 350 to 2900 R.P.M. Also 10 speeds 125 to 2900 R.P.M. available at extra cost.

FOR HIGH SPEED MILLING, DRILLING, BORING AND COUNTER BORING ON ANY ANGLE





THE Halco Hi-Speed Universal Milling Attachment has proven its importance in building tools, dies, jigs, fixtures, wood and metal patterns and other machine products. Its 4-inch vertical travel permits many milling, boring and facing operations in one setup, a factor of convenience to which is added the advantage that the unit can be easily mounted by one man, it weighing only 90 pounds. Each head is unconditionally guaranteed for six months.

IMMEDIATE DELIVERY

(Designers and Builders of Fine Machine Tools)

SEND TODAY FOR FOLDER

AJAX ENGINEERING & MFG. CO.

MANUFACTURERS OF HALCO PRODUCTS

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PM CO

THIS MARK TELLS YOU

"IT HAS TO BE GOOD"

The PM Diamond Emblem is never put on a single tool until *after* it is checked against our own exacting standards of precision, hardness and finish. PM Tools carry this mark as assurance to you of their essential goodness—their ability to turn out accurate work under tight production schedules.

The PM heavy-duty Face Mill illustrated here is typical of PM Cutters. It provides for quick and accurate adjustment or replacement of the cutting members, and maintains a high degree of precision under severe usage.

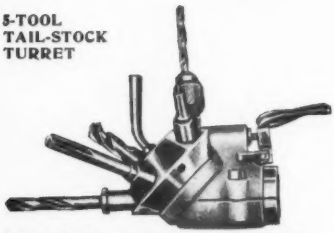
PM Small Tools and Gages are ready to help you produce more units—of controlled dimensional accuracy and uniformity.

THE NEW PM CATALOG shows a wide variety of standard gages that are regularly stocked for immediate delivery. And correspondence is invited on special tools and gages of all types.

The PIPE MACHINERY COMPANY Cleveland, O.

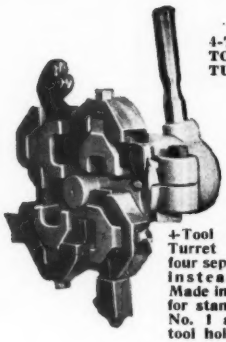
GAGES · HOBS · MILLING CUTTERS · SPECIAL TOOLS

5-TOOL
TAIL-STOCK
TURRET



5-Tool Tail-Stock Turret accommodates five tools and each tool centers automatically when brought into position by means of an indexing plunger. Made in four sizes to fit small bench lathes up to lathes with 24" swing.

4-TOOL
TOOL-POST
TURRET



4-Tool Tool-Post Turret carries four separate tools instead of one. Made in two sizes for standard 0, 00, No. 1 and No. 2 tool holders.

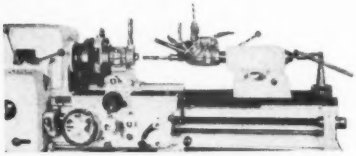


Photo above shows Jefferson Turret Attachments on 16" Engine Lathe.

ENGINE LATHE TO TURRET LATHE

in 15 seconds

JEFFERSON NO. 101 SWING FRAME GRINDING AND POLISHING MACHINE

For wheels up to 14" dia. Can be swung full universal: forward, backward, up, down, right, left, at any desired angle. Does the work of 2 men. Delivery 20 days.

Don't wait for Turret Lathes . . . You can convert any engine lathe into a complete precision turret lathe in 15 seconds with the Jefferson 4-Tool Tool-Post Turret, 5-Tool Tail-Stock Turret and Adjustable Pull Feed—and double its capacity. For forming, roughing, boring, finishing, drilling, tapping, etc.

Jefferson Turrets are real production tools—substantial, rigid, accurate and adaptable to any size or make of engine lathes. They must not be confused with the small makeshift gadgets now on the market.

Adjustable Pull Feed eliminates slow movement of tail-stock spindle and provides easy control. For any lathe up to 24" swing. Delivery, 6 days. Write for Details.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.

How To Step Up Your TAPPING OUTPUT

Hundreds of users of Procunier Tapping Machines (names on request) will give you day-by-day figures proving that these machines definitely speed up tapping operations, do more accurate work and reduce tap breakage. There are specific reasons for this superior performance of Procunier machines: 1. The improved Procunier tapping head with double-cone coak-face friction clutch and other exclusive features; 2. Four speeds, ranging from 390 to 2050 RPM, efficiently handle jobs for which conventional high speed tapping machines are inadequate; 3. One machine handles tap sizes from No. 2 to ½" through two interchangeable heads; 4. Extra long Spiral Compensating Springs conveniently located, with wide range hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF OPERATOR.

Tap Establishes Its Own Lead

The new Procunier Universal Tapping Machine is exclusively designed so that it actually allows the tap to establish its own lead. There is nothing more accurate than a precision ground thread tap as a guide for tapping—so maximum tapping efficiency is attained where an accurate tap is free to establish its own lead in cutting the thread.

SEND FOR CATALOG giving full details, description and prices on the full line of Procunier Universal Tapping Machines, hand or foot operated, the complete line of Procunier Precision Tapping Heads to meet all needs and the new Tru-Grip Tap Holder.

PROCUNIER

SAFETY CHUCK COMPANY, 12-14 S. Clinton St., Chicago, Ill.

PROCUNIER SAFETY CHUCK COMPANY
12-14 S. Clinton St., Chicago, Ill.

Send me bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name .....

Address .....

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Jessop TCM

Awarded for outstanding production achievement.

High Speed Steel Tool Bits

Hardened TCM High Speed Steel Bits are made from TCM molybdenum-tungsten high speed steel, cut to size and beveled on the ends to an angle of 25°. Bits are from the higher carbon range to assure the best cutting performance. Each bit is individually inspected for straightness, Rockwell hardness and exactness to size. In this fully treated condition, Jessop TCM Tool Bits are ready for immediate use and will give superior results. Popular sizes are carried in stock at the mill and at our warehouses for immediate shipment. We invite your inquiries. Jessop Steel Company, Washington, Pennsylvania.

JESSOP STEELS

CARBON · HIGH SPEED · SPECIAL
ALLOY · STAINLESS · COMPOSITE

"It's a Job For EX-CELL-O THREAD GRINDERS..."

... these threaded parts must be hardened and ground to *precision* tolerances ... and produced plenty fast!"

SINCE EX-CELL-O introduced the original production thread grinding machine seven years ago the standard for threaded work has definitely risen. Closer tolerances are now demanded and maintained. The use of harder and heat-treated material in the making of threaded parts no longer presents difficulties. Numerous parts today have threads ground on them directly "from the solid" (often, where the pitch is a relatively fine one, in a single pass). . . . For instance—*precision thread grinding* is the preferred method today among aircraft engine builders for finishing threads on parts such as crankshafts, engine cylinder barrels, crankshaft bearing and connecting rod bolts, tappet adjusting screws, various studs and many other threaded parts. With work pieces of ample threaded length, frequently one operator conveniently handles two or more EX-CELL-O thread grinding machines. . . . *All of which means important savings in production time!*

Over each of the four plants of Ex-Cell-O in Detroit fly three flags . . . the Stars and Stripes, as always, the Army-Navy "E" pennant, and the first United States Treasury "Bull's-Eye" War Bond flag.

This EX-CELL-O book on Thread Systems, Forms, and Measurements contains much practical information for all those using Precision Thread Grinding Machines. A request for a free copy, on your business letterhead, will be given immediate attention. Address Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit, Mich.

EX-CELL-O CORPORATION • DETROIT

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PRECISION PARTS

XLO

EX-CELL-O *means* PRECISION

These women, machining precision parts on South Bend Lathes in a vital war plant, are typical of thousands of women who are doing their part to win the battle of production.

With eager hearts and nimble fingers, thousands of American women are working shoulder to shoulder with men in vital war industries—replacing those who have left their machines to defend their country. And they are doing a fine job of filling men's shoes, for they know that the battle of production must be won to keep their men at the front supplied with the guns, planes, tanks, bullets, and thousands of other things an army must have to be victorious.

Women learn to operate South Bend Lathes in a surprisingly short time. Not that just any girl can become an expert machinist or toolmaker over night. But on certain classes of work—the kind of work you would expect a beginner to do—women are highly successful.

Quick to appreciate quality, women like South Bend Lathes. They like the fully enclosed design—the smooth operation of conveniently placed controls and the dependable precision that enables them to turn out maximum production. And, most of all, they appreciate the ease of operation which reduces fatigue to a minimum and seemingly shortens the work-day by hours.

South Bend Engine Lathes and Toolroom Lathes are made in four sizes, 9″ to 16″ swings. South Bend Turret Lathes are available in three sizes. Write for information.

TRAINING HELPS

South Bend training helps—books, sound films, wall charts, and bulletins on the care and operation of a lathe—are available for training new operators. Write for a copy of Bulletin No. 21-C.

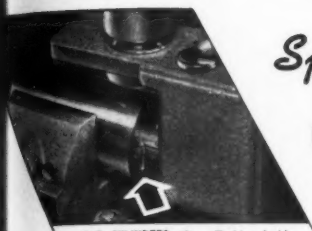
ARMY E NAVY

SOUTH BEND LATHE WORKS

SOUTH BEND, INDIANA — LATHE BUILDERS FOR 36 YEARS

HOW THE *New* GORTON SPIT-FIRE ARC ETCHER

Speeds PERMANENT MARKING OF Hardened Parts Tools, Gages Gears, Rods Bushings Collets etc.



FOR CYLINDERS, etc. — Etching inside cylinders, cavities, cones, etc.

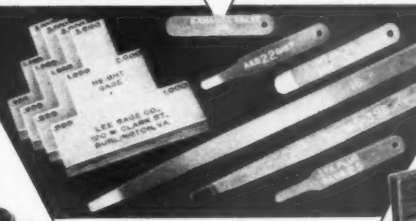
FOR V-BLOCKS, etc.— Etching both sides of a V, and in most inaccessible places.

FOR GEARS, etc.— Highly polished or ground parts, hardened pins, etc.

FOR CONNECTING RODS, etc.— Automatically follows curvatures.

PORTABLE **ETCHER UNIT FITS** standard Gorton Engraving Machines. For other makes, consult factory, state make.

MODEL A-E ETCHING MACHINE Complete with "Spit-Fire" Etcher Unit.



FOR GAGES — Highly efficient on delicate parts, such as .0015" thin feeler gage stock, and on an endless variety of sizes and shapes.

PRESENT DELIVERIES 2 to 4 WEEKS

Precision Etches
240 BALL SOCKETS EVERY 60 MINUTES
Every 15 seconds the Gorton "Spit-Fire" electrically etches these ball sockets— Accurately . . . Legibly . . . Permanently.

For Accurate
HIGH PRODUCTION ETCHING
Deeply Etches Hardened Parts without Burr

MARKS GOODS IN FINISHED STATE—Most efficient on highly polished or ground surfaces, large or small.

PERMANENTLY ETCHES — LIGHT OR DEEP — from .0001" to .003" deep, and from .0075" to .015" wide, on soft to hard metals, including hardest steels—*Any Shape,* on flat or irregular surfaces — without Forming Guide.

SIMPLE OPERATION—QUICK SET-UPS—Uses unskilled operator. Requires no acid, no pressure. Operates on 110 to 120 volts, 60 cycles AC only.

FOR FULL DETAILS WRITE FOR FREE BULLETIN 1830-A

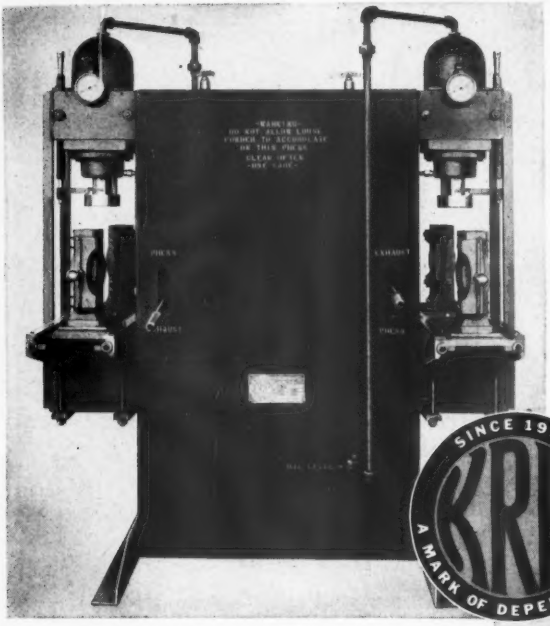
GEORGE GORTON MACHINE CO.

50 Years

1319 RACINE STREET, RACINE, WISCONSIN, U. S. A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

KRW HYDRAULIC ARBOR PRESSES

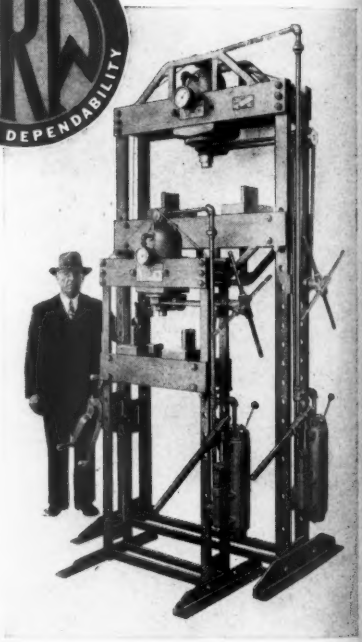


Engineered for War Production

☆ ★

Illustration below shows a special extra high 75-ton KRW Hydraulic Arbor Press in comparison with the standard 25-ton unit.

SINCE 1916 KRW A MARK OF DEPENDABILITY



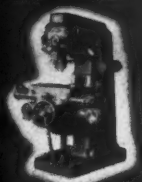
With standard KRW Hydraulic Arbor Presses as a work-proven basis, we have been able to speedily design and build many special presses for war production—without time-consuming engineering delays. The net result has been a greatly accelerated production of vital equipment which is helping to speed the day of Victory.

As an example: The large illustration shows a special, 4-man operated, air-oil press which is used extensively for bomb loading. Hundreds of these units are now in operation.

KRW also builds standard Hydraulic Arbor Presses in 25, 50 and 75-ton capacities in addition to bench-type Arbor Presses in 1/2, 1 and 3 ton capacities. If you have a problem that an arbor press might solve, talk to us. The facts concerning many successfully-solved production applications are available in our files.

K. R. WILSON
10 LOCK ST., BUFFALO, N. Y.

Machines, Accessories and Attachments for a Wide Variety of Needs:



Rotary Head Milling Machine

Autometric Jig Boring Machine

Milwaukee Midgetmill

Milwaukee Speedmill

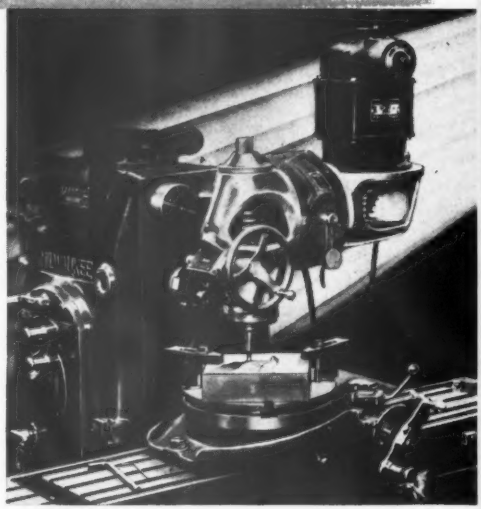
Milwaukee Face Mill Grinder

Center Scope

2 REASONS WHY MOLD AND DIE MAKERS PREFER THE MILWAUKEE MIDGETMILL

1- EXTREME SMOOTHNESS OF CUTTER OPERATION

2- MINIMUM CUTTER BREAKAGE



THE Midgetmill is designed to get the most from small tools by providing the necessary high speeds to assure accurate, trouble-free performance on the production of dies, molds, metal patterns and templets. Its unusual stability means extreme smoothness of cutter operation and a minimum of cutter breakage.

The completely universal feature, swiveling either toward or away from the column face in either direction, extends the versatility and flexibility of this attachment to hundreds of applications, including a wide variety of angular milling, drilling and horizontal boring operations.

The Midgetmill is equipped with a Thou-Meter which registers in thousandths instantaneously, eliminating costly errors. It has no graduations, dials, stops, counting turns or binding screws. One or more Midgetmills in your shop will help you to keep in step with today's demand for high speed tool and die making and other precision machining.

* * *

Write for Bulletin 662 C and information on the Milwaukee Midgetmill, the high-speed attachment adaptable to any milling machine.

* * *

Kearney & Trecker Products CORPORATION

Subsidiary of Kearney & Trecker Corporation, Milwaukee, Wis.

48-HOUR DELIVERY . . .

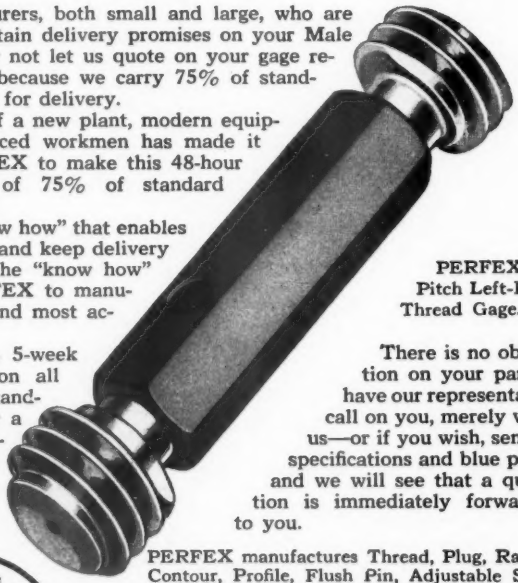
. . on 75% of standard MALE THREAD GAGES!

For you manufacturers, both small and large, who are worried over uncertain delivery promises on your Male Thread Gages, why not let us quote on your gage requirements today, because we carry 75% of standards in stock ready for delivery.

A combination of a new plant, modern equipment and experienced workmen has made it possible for PERFEX to make this 48-hour delivery promise of 75% of standard male thread gages.

Yes, it's the "know how" that enables PERFEX to make and keep delivery promises and it's the "know how" that enables PERFEX to manufacture the finest and most accurate gages.

There is a 3 to 5-week delivery promise on all other PERFEX standard size gages. For a complete description of our gage line wire or write our sales department today!



PERFEX'S 4 Pitch Left-Hand Thread Gage.

There is no obligation on your part to have our representative call on you, merely write us—or if you wish, send us specifications and blue prints and we will see that a quotation is immediately forwarded to you.

PERFEX manufactures Thread, Plug, Radius, Contour, Profile, Flush Pin, Adjustable Snap, Solid Snap, etc.

ACCURACY PERFEX OUR CREED

PERFEX GAGE and TOOL CO.

3604 GAYLORD DETROIT, MICHIGAN

Cut More Steel with KENNAMETAL tools

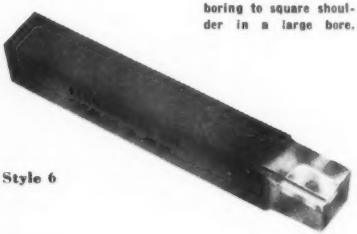
KENNAMETAL is designed for greatest possible production on steel machining jobs which include boring, turning, and facing operations.

KENNAMETAL'S great strength and hardness permit heavy feeds and high cutting speeds. Its ability to give a smooth finish on the rough cut often eliminates the need for a finished cut.

KENNAMETAL is able to economically take interrupted cuts and machine steels heat treated up to 550 Brinell hardness. Use KENNAMETAL tools to cut more steel per regrind and to get more finished jobs per tool life.

Write for your free copy of the Kennametal Vest Pocket Manual which gives complete information about these superior cutting tools.

Style 6 is for facing to a square shoulder or boring to square shoulder in a large bore.



Style 6

Style 11 is for rough turning or where a square shoulder is not required.

Style 11

Style 2

Style 2 is for facing to a corner. The opposite hand, style 1, is for turning close to chuck or shoulder.

Style 21

Style 21 is for facing operations.

McKENNA METALS Co.
500 LLOYD AVENUE, LATROBE, PENNA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
(Exclusive of Canada and Great Britain)

there IS a difference in taps

consider

FLUTING

for example:

The flutes are important in determining how long a tap will last. Flutes on Sossner taps are cut to the precise depth and width for maximum strength and best cutting angle—then mirror polished to keep friction at a minimum! That is just one of the reasons why Sossner taps last longer!

TAPS AND GAGES OF AMERICAN NATIONAL AND BRITISH THREAD FORMS IN SPECIAL AND STANDARD SIZES

TAPS
GAGES

SOSSNER

STEEL STAMPS
CUTTING TOOLS

"32 year reputation for reliability and precision workmanship."

Write to SOSSNER, 161 Grand St., N. Y. C. or 27 Broadway, Lynbrook, N. Y.

3 NEW WAYS

to speed output . . .

1 "MX" WHEELS combine light stock removal with finishing and polishing action. They are free-cutting and are to be used dry on any portable machine. For breaking down sharp edges on gears, etc., finishing and polishing out-of-the-way places.

CARBORUNDUM PRESENTS 3 NEW "WEAPONS FOR PRODUCTION"

KEEPING pace with the war program, Carborundum has developed many new and novel coated abrasive products—Weapons for Production to speed output, insure high finishes and lower costs. Here are three of the most versatile and useful! They are particularly adapted for finishing and polishing out-of-the-way places on airplane engine parts and similar metal work.

1. ***"MX" Wheels*** are fabricated from cotton fibres intimately intermingled with Aloxite Brand Aluminum Oxide or Carborundum Brand Silicon Carbide grain. They are made in six grades of hardness.

2. ***Cloth Cartridge Rolls*** are made in diameters from 3/8 to 1 inch of tightly wound, glued strips of metal working abrasive cloth. Rolls are from 1 to 3 inches in length.

3. ***Multi-Slotted Discs*** afford a time-saving, cost-saving way to burr and polish the edges of holes in metal work. Produced in all necessary grits, in diameters from 1/2 to 6 in.

CARBORUNDUM

2 CLOTH CARTRIDGE ROLLS can be mounted on a spindle and used on a portable tool for finishing hard-to-reach surfaces. As abrasive surface wears down, cloth backing can be torn off to expose fresh layer of abrasive.

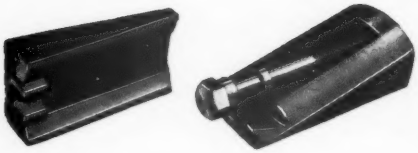
3 MULTI-SLOTTED ABRASIVE DISCS simplify the job of removing the burr and producing the true radius required on holes. Used in a portable power tool, the disc "cones" backward, finishing only the hole edge. When two discs are mounted together back to back, they can be used to finish both edges.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks and MX is a trade-mark of, and indicate manufacture by The Carborundum Company)

No Need to look for LEVEL spots with this



"Empco JACK"

HERE'S HOW YOU CAN SET-UP YOUR MACHINES ON YOUR OLD FLOORS!

Why waste time trying to find a level spot to relocate your equipment? With this self-aligning EMPCO JACK you can "set-up" anywhere more quickly and accurately than ever before.

This new EMPCO Leveling Jack consists of only three parts: The upper and lower castings and the adjusting screw. The two castings are so fitted as to permit sufficient "float" for self alignment. This feature presents a full bearing and maximum support either on an even or irregular floor, hence with EMPCO Jacks there is *no need of level spots for machine locations.*

Quick Two-Way Adjustment

EMPCO Jacks greatly simplify entire operation of setting up and maintaining equipment level: Rest base on a set of No. 1, 2 or 3 Jacks according to the weight. Apply a wrench to the "hex" head of the adjusting screw and a micrometer-like adjustment is obtained *either up or down*, until your spirit level reads "zero".

PROMPT DELIVERY

Write for sizes and prices today.

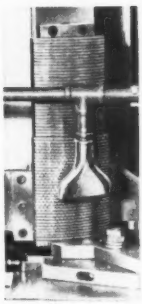
EMPCO

THE ENTERPRISE MACHINE PARTS CORPORATION

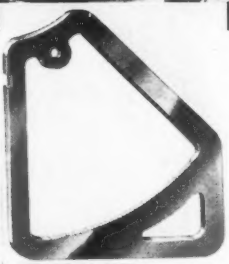
2735 JEROME AVE. DETROIT, MICH.

LINES BEHIND THE LINES

"ALL THIS AND TIRES TOO!" SAYS THE 100% CONVERTED RUBBER INDUSTRY, NOW MANUFACTURING IMPLEMENTS OF MECHANIZED WAR



BROACH DESIGNED, with special engineered clamping and holding fixture, by *American* (above), finishes radius and cuts teeth with a single pass of the tool.



BROACHING MACHINE (right), *American* made V-1½-4 ton, reduces set-up, loading, and operating time — does a precision job at a production rate!

BROACHING IS BETTER THE *American* WAY

BY SPEEDILY CONVERTING part of its plant to the manufacture of guns and other munitions, rubber eminently deserves credit as one of the production lines behind the firing lines. Noteworthy is the industry's recognition of broaching as a better way to do many metal-working jobs—the only *right* way to do some!

* * *

TEETH IN GUNNER'S QUADRANT *(left)* are one of the forms which only broaching can do with the speed and precision required.

American

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

Production records in leading munitions plants have demonstrated the extraordinary capacity of TECO Carbide Dies for cartridge case production. Because of rigidly controlled density, hardness and uniformity, TECO Dies reduce wear and friction to a minimum —hold accurate tolerances for much longer runs— finish smoothly—and eliminate rejects.

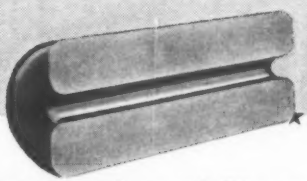
Step up your cartridge case output by using TECO Carbide Dies for drawing, sizing, necking and tapering. Our engineers will gladly discuss your requirements.

TUNGSTEN ELECTRIC CORPORATION, 574 39th Street, Union City, N. J.

BRANCH OFFICE: 2906 Euclid Avenue, Cleveland, Ohio
REPRESENTATIVE: Architects & Builders Bldg., Indianapolis, Ind.

TECO *Pioneers in Tungsten Carbides for over a Quarter Century* **CARBIDE DIES**

SUNNEN
Precision HONING MACHINE



Average Number of Pieces from Header Die Increased from 25,000 to 225,000!

That's MORE Production

An increase of nearly 1000% in the number of pieces from a die after it had been Sunnen honed!

That's the kind of increased production that will help us speed the day of victory.

We can't assure every manufacturer such amazing results—but increases in production of 100% to 500% are being reported almost daily.

If you are reaming or grinding internal cylindrical surfaces from .185" to 2.400" in diameter, it will pay you to get full information on this practical, inexpensive, accurate equipment at once. Consider the value of these outstanding features:

1. Does not require skilled labor.
2. Can be set up and work located in one minute.
3. Accuracy within .0001" guaranteed.
4. Produces super-smooth finish.
5. Corrects errors of out-of-roundness or taper caused by previous operations.

Write for
FREE BULLETIN
—giving complete information and showing many examples of use. Or, if you prefer, we'll have an Application and Service Engineer call and demonstrate this equipment in your plant on your job.

SUNNEN PRODUCTS COMPANY
7947 Manchester Avenue
St. Louis, Missouri

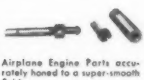
Canadian Factory
Chatham, Ontario

SUNNEN

Aluminum Aircraft Link "produces high finish without bell-mouthing."

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. 4-Micro finish.



Airplane Engine Parts accurately honed to a super-smooth finish.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Saved time in producing a smooth, accurate finish o this bronze remote control alve body.

"Produced an extremely accurate and glass-like finish."

Cones for Wheel Balancing Machine "Accurately align bores two interrupted surfaces."

Drill Jig Bushing "Increases sales appeal of product."

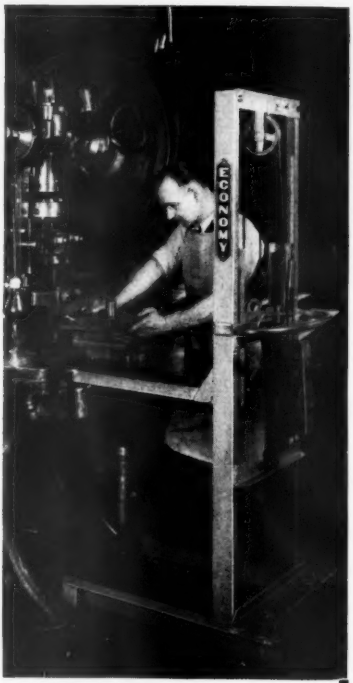
Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

SAVE PRODUCTION TIME
with a SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 57" above floor and lowers to within 8¼" of floor. Overall height 72". Size of platform 24"x24" steel plate. Crank, up and down, hoist unit.



Price
$147.50

ECONOMY ENGINEERING CO.
2659 W. Van Buren St., Chicago

IMMEDIATE DELIVERY

DOUBLE THE TOOL LIFE
at Half the Tool Cost!

WITH SUTTON MASTER FEED FINGERS AND INTERCHANGEABLE AND REPLACEABLE PADS

One master and different sets of pads will handle practically the full range of work on any machine, and worn out pads can be quickly and easily replaced in the original master. This cuts your tool cost as much as 80%. But, since the pads are separately hardened, to resist wear, and can be ground many times to restore size, they outlast ordinary one-piece feeders two or three times.

NO PINS OR SCREWS TO WORK LOOSE. A lug on one of the pads engages a slot in the master; there are no pins or screws to vibrate loose and jam the machine.

COMPENSATION FOR WEAR—Double angles on the sides of each pad can be ground down many times to restore hole size, the tension of the master bringing the pads together.

TAPERED FOR STOCK ENTRY—Master and pads are tapered to admit stock easily—no jamming.

QUICK, EASY PAD CHANGES—Each master is furnished with a set of spreaders, one for each slot, which allow fast interchange of pads.

SELECTIVE HEAT-TREATMENT—The threaded end of the master is toughened . . . the remainder is spring-tempered. The pads, being separate, can be hardened for extreme wear-resistance.

COLLETS • MASTER COLLETS AND PADS
FEEDERS • MASTER FEEDERS AND PADS
PARTS AND ACCESSORIES for lathes . . . milling machines . . . and automatic screw machines.

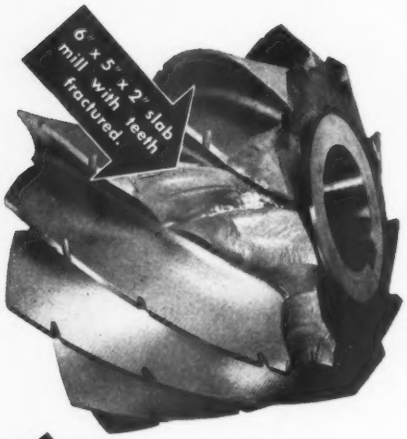
SUTTON TOOL COMPANY
2895 W. Grand Blvd. • Detroit

SEE YOUR SUTTON REPRESENTATIVE or send for Catalog No. 15

SUTTON Diamond Grip **COLLETS**

DON'T SCRAP

YOUR BROKEN HI-SPEED STEEL TOOLS!



"SUTTONIZING"

IS ON THE TOP!

"Suttonizing" has earned and is holding this "top spot" in the welding reclamation of hi-speed steel tools. Tough jobs have not slowed down "Suttonizing"—but rather have boosted its popularity unbelievably in the year that it has been used for salvaging most all types of difficult to repair tools. Wire or write for our catalog describing the "Suttonizing" method.

HERE ARE SOME TYPICAL TOOLS RECLAIMED BY "SUTTONIZING". Fractured teeth can be repaired on the following: shell mills • large size end mills • plain mills • broaches (subject to our approval) • side mills (cracked 4" O.D.—low limit) • boring, slotting, cut off and turning tools repaired or fabricated.

WELDING EQUIPMENT & SUPPLY CO.
226 LEIB STREET • DETROIT, MICHIGAN

WHEN YOU MUST CLAMP THINGS OF VARYING THICKNESSES

...use this KNU-VISE clamp of versatility

Because this KNU-VISE Clamp permits a wide range of clamping applications while base remains fixed in the same position—because it will hold parts or assemblies that may vary in thickness as much as 15°—and because it can be pivoted around the base to any angle or height within 90°—this model is gaining great acceptance in industry. It is raising the efficiency of clamping and eliminates tedious and slow hand adjustments.

Send for new catalog

KNU-VISE INCORPORATED

1330 Plum Ave., Detroit, Mich.
4328 San Fernando Rd., Glendale, Calif.

HOW TO TORCH-BRAZE CARBIDE TIPS TO SHANKS AND GET TOOLS ON THE JOB FAST

To get carbide tools on the job *fast*, many plants maintain an active stock of standard Carboloy Cemented Carbide tips—ready for brazing to shanks. In this way, carbide tools can be made available for most jobs within an hour after the need arises. Saves weeks—often months—of time—particularly on non-standard, made-to-order type of carbide tools. For this work you need simply an oxy-acetylene torch, and a few brazing accessories including flux, silver solder sheet or rod, etc. Procedure is simple, fast and efficient. Technique quickly acquired, even by inexperienced personnel. Carboloy Training Film available at $3.50 for fast instruction.

◂ After milling and grinding shank angles, mill recess in shank to fit carbide tips. Cut silver solder sheet (.003" thick) slightly larger than recess. Clean tip, sheet and recess with carbon tetrachloride.

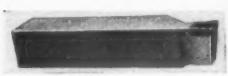
Place shank in vise as shown. Apply flux liberally ▸ to shank recess and well back of recess. Flux silver solder sheet; place in recess. Flux carbide tip; place in recess. Assembly now ready for brazing.

Large Standard Tools in Stock for Heavy Work

A range of large size standard tools suitable for heavy cast iron and steel cutting work on boring mills, lathes, etc., are now in stock (1-13-43) available for immediate deliveries. In standard styles Nos. 4 and 7 (right and left hand straight turning) and Nos. 13 and 14 (15° side cutting-edge angle, left and right hand turning). Sizes $1\frac{1}{2}$" square and $1\frac{1}{2}$" x 2". Grade 44A for cast iron; 78B for steel.

Standard-Design Carboloy Tools for Cutting Off to Hollow Cores

Following an analysis of thousands of cut-off tools ordered in the past, standardized



designs have been established for tools of this type. These cut-off tools are easy to order, speed up deliveries and eliminate special drawings. Standard-design Carboloy cut-off tools are designed for cutting off to hollow cores, such as on shell forgings, etc. Write for catalog GT-142.

◂ Adjust oxy-acetylene torch to 10 lbs. pressure on both gages, with a tip of green flame and blue flame as shown.

Apply torch along ▸ bottom. Keep moving. Then work around sides and end of shank. Avoid excessive or spotty heating.

◂ When solder melts and shank and tip become dull cherry red, direct flame on the tip.

Then take a hold- ▸ ing rod and move tip back and forth to wipe in joint and distribute silver solder evenly.

◂ Now remove flame and press down squarely on tip. Heavy pressure not needed. Hold until silver solder sets.

Set tool aside and ▸ allow to cool naturally. Do *not quench* in liquids as tip may crack.

CARBOLOY COMPANY, INC.

Sole makers of the Carboloy brand of cemented carbides

11109 8 MILE AVE., DETROIT, MICH.

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia

Pittsburgh • Seattle

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY CEMENTED CARBIDES

TRADEMARK

TOOLS • DIES • DRESSERS • CORE BITS • MASONRY DRILLS • WEAR RESISTANT PARTS

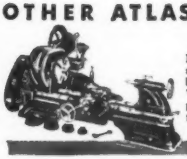
"MATCH THE MACHINE TO THE JOB — use fast precision bench tools to take over the production of small parts so that capacities of larger machines will not be wasted." That Atlas idea is helping thousands of plants, large and small, step up production in the victory program. And an important tool in the production drive is the Atlas Milling Machine.

HERE is a real bear for precision work — rugged, compact, powerful. It handles the full range of milling — from slabbing and facing cuts to end milling, keyways, finishing and layout work. It has backgeared power, complete V-belt drive, 12 spindle speeds, and operates from a 1/3 HP 1740 RPM motor. Precision-ground table is 4½" x 18". Three types of table controls are available. Send for complete information to the Atlas Press Co., 212 N. Pitcher St., Kalamazoo, Mich.

ARMY E NAVY

Atlas
ATLAS PRESS CO.

OTHER ATLAS EQUIPMENT FOR WAR PRODUCTION



LATHES Backgeared, screw-cutting lathes with V-belt drive, power cross feed.

SHAPERS Handle all work within a 7" stroke accurately, quickly.

DRILLING MACHINES Step up production on small-hole drilling, tapping, 4, 3, 2-spindle models.

Tannewitz VARIABLE SPEED BAND SAWS

Instantly adjustable to the IDEAL Speed for cutting Metal of EACH and EVERY Type!

● In cutting off gates and risers from castings of various metals, practically any size, in cutting steel sheets up to ¼-inch thick, cast iron, plastics or any one of dozens of other cutting operations, a TANNEWITZ Variable Speed Metal Cutting Band Saw will do it quicker, better, and show a handsome return on the investment involved. There are five new models in addition to our regular High Speed Band Saws, including those which handle work as wide as 52 inches, and those with 48-inch clearance beneath the guide. Get a line on the TANNEWITZ metal cutting band saw that fits your particular needs. It will save time, step up production and repay its cost dozens of times. Write for full particulars NOW!

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

TRIPLE THREAT MACHINE

With

Vernier Precision

Index Mills For 1943

Manufactured by

Index Machine & Tool Co.

Are the same highly versatile machines with new and heavier column, knee, saddle and table. Well over two hundred INDEX MILLS were sold in the City of Detroit alone in 1942; many of these were on repeat orders.

If you do not know about this fine machine which has taken a prominent position in the Victory program milling, drilling and boring on tool, die, experimental and production work, you should write today for descriptive folder and quotation.

Write to:

Blank & Buxton Machinery Company

3110 E. Michigan Ave., Jackson, Mich.

The REED Policy of PLANT EXPANSION

These 4 Simplified Types
TO MEET TODAY'S DEMAND for micrometers the REED factory is temporarily devoting its entire production to the following four models.
No. 801 plain, reading to 1/1000". Price .....$6.25 list
No. 901 plain with vernier reading to 1/10,000". Price ... $10.25 list
Two Types of Two Inch REED MICROMETERS Now Available
No. 802 plain, reading to 1/1000". Price ....$7.00 list
No. 902 plain with vernier reading to 1/10,000". Price .....$9.75 list
Note: For the time being, no lock-nut ratchet micrometers are being manufactured.

REED MICROMETERS Have Been Manufactured in the U. S. A. for 30 Years

Increased Production and Simplification of Models

are aiding us to deliver micrometers to plants that can furnish preference ratings and to mechanics who can fill in our simple form proving that they are working on war production.

FOUR REASONS for the Increasing Popularity of REED MICROMETERS

1 Lead accuracy over the full range of the screw is within a fraction of 1/10000" due to REED'S exclusive process used in forming the micrometer thread. This process makes variations virtually impossible.

2 Longer life of the micrometer screw due to a burnishing process which compresses the surface of the thread making the steel more dense, resulting in greater resistance to wear.

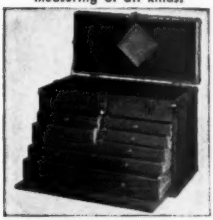
3 Easy reading graduations on thimble and vernier due to freedom from glare and reflection.

4 Fine, sensitive touch because of the smoothness and accuracy of the thread over its full length.

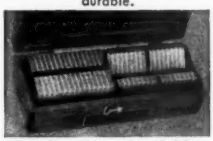
Write today for literature describing the simplified types of REED Micrometers now being produced in ever increasing volume.

SCHERR MACHINISTS' TOOL SPECIALTIES

MACHINISTS TOOLS in a wide range of types for precision measuring of all kinds.



TOOL CHESTS with separate locks for open top and drawer section. Light weight but strong and durable.



Grinding Room Specialties
MAGNE-BLOX laminated magnetic parallels and V blocks for holding work that cannot be placed directly on magnetic chuck.

"LITTLE WONDER" RADIUS DRESSER — will dress convex or concave radii from 0 to 1" without removing wheel guard.

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[FEATURES

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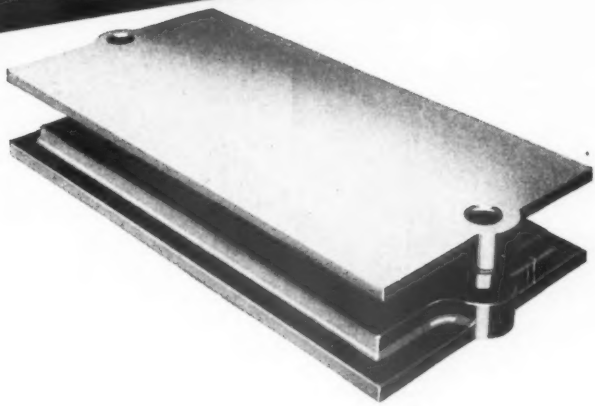

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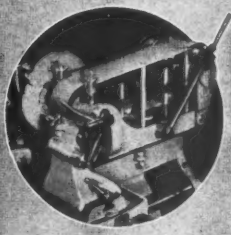

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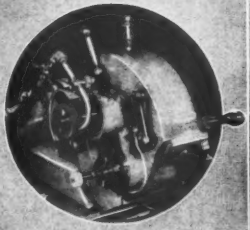

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Grinding cap., hole dia.	up to 3"
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Automatic table travel	
Standard	½" to 2"
Special	½" to 4"
Hand table travel	11"
Swing over table	8"
Center distance	8"
Workhead swivel	90°
Table swivel	5°
Cross feed graduations	
Standard	.0005"
Special	.0001"
Travel of cross slide	1¾"
Collet capacity	⅞"
Step chuck capacity	6"
Jaw chuck capacity	6"
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Grinding spindle speeds:	
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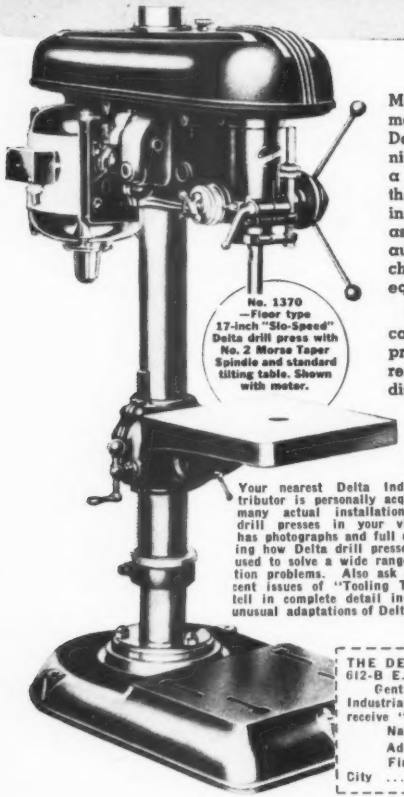

No. 1370 —Floor type 17-inch "Sio-Speed" Delta drill press with No. 2 Morse Taper Spindle and standard tilting table. Shown with motor.

Many problems that stump production men have been successfully solved with Delta Drill Presses. This has been definitely proven in thousands of cases—on a large variety of operations. Today, these efficient, flexible machines are being used in thousands of plants not only as production line equipment—but as auxiliary machines, special purpose machines, for special set-ups and tool room equipment.

Throw overboard your notions of what can be accomplished with standard drill presses—and get the full details of this remarkable story. You will be in for a distinct surprise!

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Your nearest Delta Industrial Distributor is personally acquainted with many actual installations of Delta drill presses in your vicinity. He has photographs and full details showing how Delta drill presses have been used to solve a wide range of production problems. Also ask him for recent issues of "Tooling Tips" which tell in complete detail ingenious and unusual adaptations of Delta machines.

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Today, the Turner Gauge Grinding Company can make and keep delivery promises on all standard ring and plug gauges; because they carry in stock, at all times, standard ring and plug gauge blanks turned up and hardened ready for finishing and final inspection. If you need ring or plug gauges in a hurry wire or write us today and we will see that you receive delivery within a short time.

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Recently a Purchasing Agent handed a Distributor's salesman an order for a set of Gauges—normally a stock item with any well-equipped Jobber.

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"We haven't quit trying," he reminded the P. A.—from his own office he called a responsible manufacturer 600 miles away. "Yes," replied the Gauge man, "we have some of those sizes and will ship today."

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

When the Distributor billed the job, he added $6.00 normal gross profit. Then he paid the Telephone Company a $4.00 toll, leaving $2.00 for himself. Still he feels he is away ahead because one of his standard policies is to say "thanks—sure we'll take care of you on every order."

You like to do business with firms like that and so do we. Years ago we began appointing them *our* Distributors—and *your* close-at-hand source of supply for Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout Industrial America.

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STRATEGY FOR PEACE

Letter from Washington by George J. Huebner

THIS bit of writing is intended to be, not a plan for winning the war but a thought-provoking statement about winning the peace.

We shall win the war. We must. But will we win the peace? There are some misgivings about that, despite convictions that it is just as essential to the welfare of our nation and to all the world as winning the war.

The strategy for winning the war we are leaving to our military experts who are trained for it. Your part and mine is to do what we are told because there must be unanimity of purpose and action.

But with the return of peace must come our return to the processes of democracy—unadulterated democracy. A big part of the responsibility for making certain of this will fall upon American business, not capital alone, not labor alone, but capital and labor together.

Now is the time to put an end to the legend which employer-employee disputes have built up that capital and labor can exist without each other. It must be evident to every business man that without workers he has no business, and to the worker that without factories and stores he has no job.

To start a business, small or large, one must have capital. It may be the accumulated earnings of a salesman or the savings of a shop worker. It may even be a widow's life insurance or an orphan's inheritance from a soldier father. When it is invested in the assets of a business it is indisputably capital.

It has been one of the blessings of American citizenship that any intelligent man can become a business man in his own right. And when it takes place, the transition is from worker to employer, from earner by trade or vocation to earner from capital.

Capital and labor do not have two causes opposed to each other. As Americans they are free under the same Bill of Rights, they stand on the same platform—Free Enterprise.

Despite the fact that Free Enterprise and its concomitant, the American Way of Life, are phrases which have been so bandied about that the grandeur of their meanings has been dulled, they describe what American capital and labor must protect, must make certain becomes a part of the Strategy for Peace.

Cooperation based upon a just return for invested capital and a genuinely ample wage for labor will be needed as never before to carry us from the wasteful, extravagant war economy into an era of constructive peace. Lack of cooperation between these groups of American business will bring confusion, perhaps disaster. Few industries will be the same after the war. The need is for careful analysis and resourceful planning. For some industries it must be world-wide planning because we shall stand before the world as the nation which voluntarily laid its physical assets upon the altar of liberty for all mankind.

Our Strategy for Peace in the world can be successful only if it is based upon good-will and cooperation at home.

By Hydraulic Press
Manufacturing Company

Deep Metal Drawing in the Aircraft Industry

Successful applications of new techniques to the mass production of aircraft parts has done much to speed airplane production. The deep drawing of metal on hydraulic presses described in this article is an excellent example.

TODAY, mass production methods, including conveyor lines, are in operation in a number of airplane plants. The Douglas Aircraft Company's plant at Santa Monica has been one of the leaders among airplane builders in applying mass production methods. This has been possible through unique methods used to supply metal parts to the high speed assembly line. "Dural" parts are classified into two distinct types—those produced by the Guerin "rubber pad" process and those deep drawn with regulation metal working dies.

Both of these hydraulic press applications were pioneered in the aircraft industry by Douglas with the Hydraulic Press Manufacturing Company designing and building the self-contained hydraulic presses for these special applications.

Fig. 1 (left) — A massive Fastraverse blankholder press deep draws upper tank sections for a Douglas troop transport.

There are a great number of metal aircraft parts that cannot be formed by the rubber pad method. Usually these are parts requiring deep draws. Originally these parts were made in drop hammers, but gradually these hammers are being superseded.

The reason is a very simple one—the drop hammer method requires a series of progressive drawing operations to perform a single deep draw. Although metal dies are employed, sheets of rubber are placed between the blank and the female lower die. Before each hammer blow, a portion of the rubber is removed. This frees more metal and permits the draw to be lengthened at the next blow of the hammer. Some parts require as high as twenty successive strokes of the hammer. If less strokes were used, the sudden impact of the punch contacting the work would fracture the metal. Even with this progressive method, wrinkles cannot be eliminated. Usually the part must be transferred to the power or "bumping" hammer one or two times during the drawing operations to have the wrinkles removed.

With the present demand for aircraft, faster and more efficient methods had to be employed.

At first the production problem looked simple. For those who suggested the

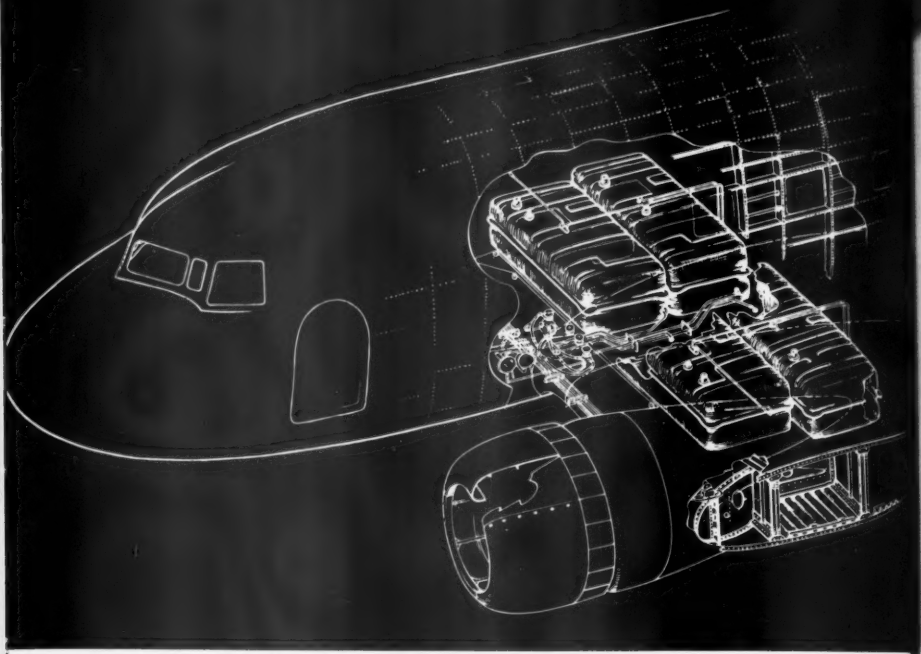


Fig. 2 — An isometric drawing of a Douglas cargo carrier showing position of the metal gasoline tanks, sections of which were deep drawn.

automobile manufacturing methods, many obstacles were encountered. The automotive industry has special alloy steels made to accommodate particularly difficult forming operations. The fabricator of aircraft sheet metal parts must use a standard alloy as furnished by the duralumin manufacturers, since the metallurgy of aluminum alloys is not sufficiently advanced to permit the manufacturers to readily change the characteristics of their product by simple changes in the composition. Airplanes were much more complicated than automobiles—a great many more parts and assemblies per unit. Also contracts for any one model of plane were let in quantities of hundreds instead of thousands as was the case with automobiles. Besides this, there were no steel dies, no press equipment except for the slow hammers. The rubber pad presses, due to increased production, were reaching capacity output.

With the ever-present possibility of a change in design, it was decided that the best answer was press equipment which would deep draw parts rapidly and without wrinkles, all in one operation, using reclaimable metal dies. To save die cost and die manufacturing time, the presses had to be of a precision type so that guides need not be incorporated into the die designs. Also due to short run production, dies had to be changed quickly. Of all the press equipment owned by the automobile makers and metal stamping plants, H-P-M hydraulic blankholder presses seemed to "fill the bill." There were several reasons why.

When deep drawing sheet metal with Fastraverse blankholder presses, three major actions may be incorporated into the die design:

1. Main draw punch carried by the main press slide.

2. Blankholder ring carried by the blankholder slide.

3. Die bottom carried by the die cushion platen, located in the press bed.

The blankholder die ring has accurate lateral alignment and is rigidly supported by the blankholder slide located directly above.

With the blankholder slide adjusted up against the main slide and the lower die cushion inoperative, the press operates as a single action press for coining, forming, etc.

With the blankholder slide adjusted up against main slide, and the die cushion only operating with the main slide, the press operates as a single action press with a cushion in the bed. With this arrangement, the female die is fastened to the main slide and the male die or punch is mounted on the press bed.

With blankholder and die cushion both functioning with the main slide, the press operates with double action above, plus cushion in the bed. The die cushion can also be used as an ejector.

With the blankholder press, deeper draws per operation are made possible. Waste of stock and production time is avoided by elimination of wrinkling and metal fracture. The draw punch advances to the work rapidly but automatically slows down prior to contacting the blank. Besides eliminating the possibility of metal fracture at this point, die life is lengthened due to this slowdown feature. There is virtually no thinning down of the stock—even in deep intricate draws. There is no distortion of the finished form after release from the dies. This method of applying pressure gives the molecules of the metal adequate opportunity for their necessary rearrangement — in other words, the metal is "set." Corners are brought out sharply and squarely.

Shockless press reversal is accomplished by employing a "valveless" closed circuit operating system. A single radial piston type pump generates the pressure for all press actions. Pressure first applied to the main press ram is distributed to the blankholder and die cushion. No additional sources of hy-

Fig. 3 — Drawing of the Meehanite die used to make top section of the gasoline tank for Douglas troop transport.

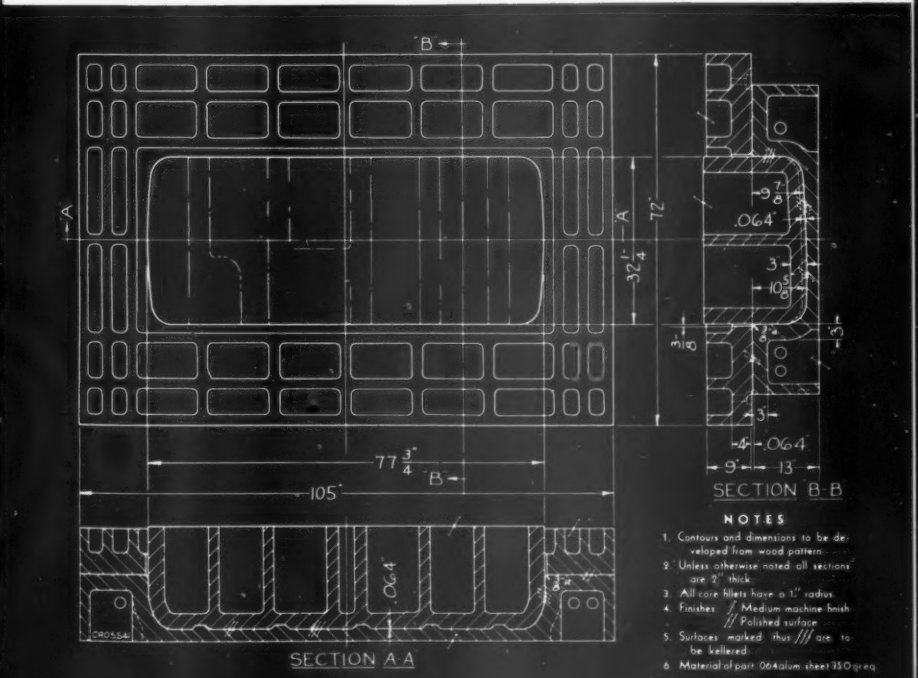


Fig. 4 — All parts were drawn with the press illustrated below with Kirksite "A" die stock.

draulic power are required to actuate these second and third pressure members.

An oil prefill device permits rapid travel of the press slide to and from the work without cavitation and time loss.

Control of the press is performed through utilizing the reversible discharge feature of the radial pump. The radial pump is fitted with a hydraulically actuated servo-control and so arranged to determine both speed and direction of press movement. This permits not only continuous or intermittent reciprocation of the press slide, but also a precise manual control for setting dies. This feature minimizes die setup time.

The pressure exerted by each blankholder ram can be adjusted individually and independently of other blankholder rams. This feature is invaluable when drawing parts of irregular contours where the blank must be held more firmly at a certain point on the periphery of the blankholder ring and be permitted to slip at other points. No die shimming is required—a simple adjustment at the operator's control station does this work.

(Continued on Page 181)

Fig. 5 — A smaller Fastraverse blankholder press drawing Douglas oil tank collars. Female die is mounted above. Die is made of Kirksite "A."

By C. W. Hinman
Designing Engineer

Modern Milling Fixture Design

The need for improved fixture designs has risen in direct proportion to the need for increased materials of war. This is the fourteenth timely article in the current series.

MILLING with special equipment usually means that specially designed fixtures are employed for holding the work, or that special cutters are used. It may also refer to using a specially designed arrangement of the milling machine itself. A milling machine may be built with several special features. The position of the arbor and the cutter head design may be a radical departure from a standard machine in order to accommodate the milling of unusual shapes of work.

All milling fixtures are special, but they can be used for holding work in either a standard milling machine or in a specially designed machine. Work that is held in a fixture and milled in a specially designed machine must necessarily be for a large production of parts to offset the extra cost of highly specialized equipment.

The solution of a tooling problem can be either profitable or wasteful. For milling many types of unusual shapes of work, a special machine, fixture or attachment must be used. The best policy, however, is to avoid building special machines except in cases where certain working conditions and high output warrant the extra expense. Our first attention, then, should always be directed toward building fixtures and attachments for a standard milling machine and to use standard cutters if possible. This procedure saves much time and expense.

Milling the Teeth in Conic Shaped Cutters

Large quantities of conic shaped cutters with spirally stepped diameters, called "rotary bits," are used in oil regions for certain well-drilling operations. Figure 86 shows one method for setting up three of these cutters on the arbors of a fixture designed for milling the teeth in each of five stepped diameters. The cutter blanks are turned from one solid piece of a special steel alloy. The milling machine head is of special design. It is designed to operate three vertically arranged cutting heads all in a straight line. The cutters each have two lips and are similar to a drill having a 45° included angular point.

Referring again to the picture, each of the three arbors for holding the work is inclined at the same angle as the

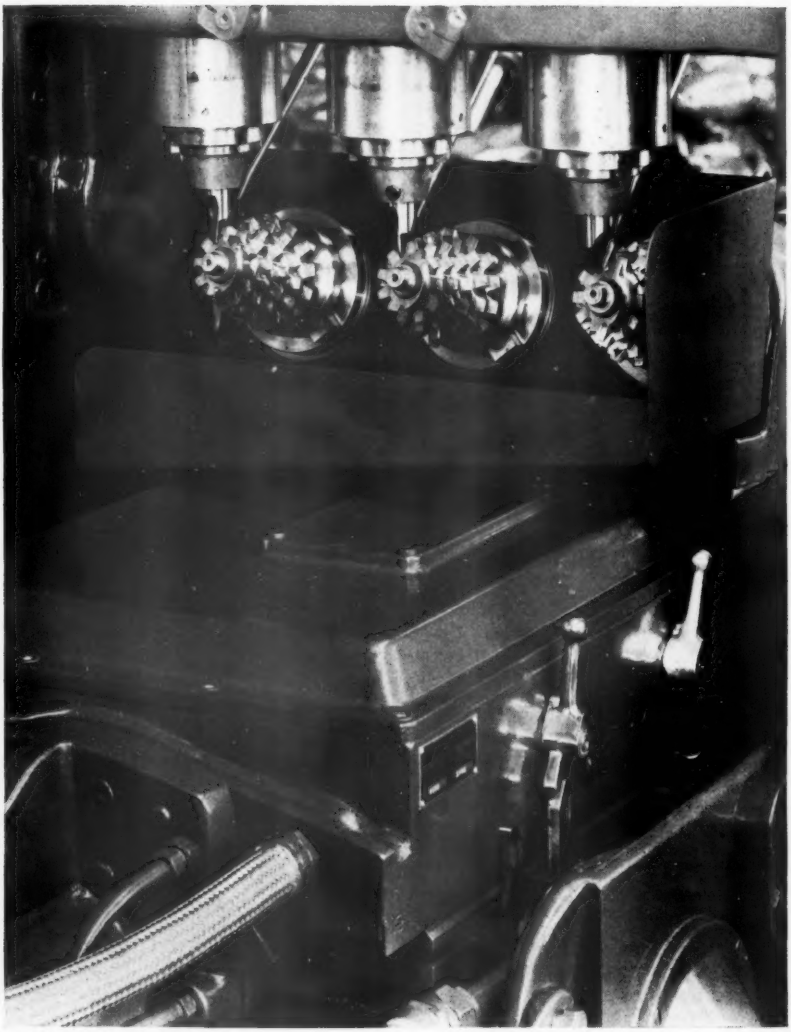


Fig. 86 — A special 3-spindle head and automatic indexing fixture designed for milling the teeth in rotary bits used for drilling wells.

angle on one side of the work. This makes it possible to cut the teeth on each of the five steps in one indexed position. The smallest cutter bit begins with a spiral lead that continues through the length of the cone. In other words, this cutter bit is simply a conical thread which is notched with cutting teeth. The operation of cutting the teeth is not high precision work and accurate indexing is unimportant.

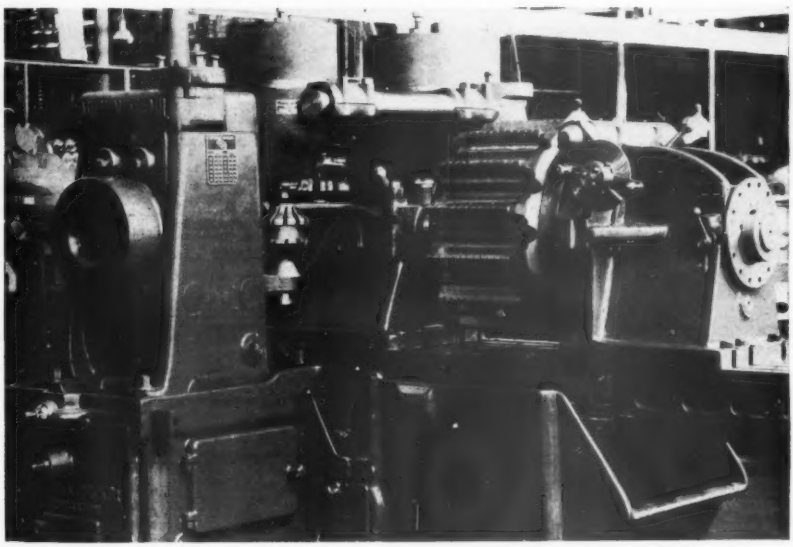
The work is clamped by a knurled nut at the ends of the arbors, and is registered on a key within the center hole of the work. Indexing from tooth to tooth is done through the action of a train of gears concealed behind the work arbors in the housing of the fixture. Shallow cuts are taken at the left arbor, deeper cuts at the center arbor and the finishing cuts at the right arbor. The table is provided with a hydraulic feed. The large enclosed housing in the foreground contains the feeding and automatic indexing mechanisms. Two adjustable "dogs" for reversing the feed are seen in front of the table. A spout for delivering a lubricant leads to each cutter. A pan for carrying chips and oil away from the table is provided under the cutting operations.

Milling Teeth in 12 Sprockets Simultaneously

Figure 87 shows a special setup in a large planer type milling machine that has two vertical cutter heads. The fixture has a large central arbor over which 12 steel sprocket wheel blanks are mounted on their center holes. At the right end of the fixture is a large dividing head at the top of which a dial plate is mounted. The dial plate has a large number of indexing holes. Two crank levers in front of the dial are revolved by the operator for indexing. This action turns the central arbor with the work by means of a concealed worm and gear. The crank is stopped by the insertion of a pin at the correct hole in the dial, thus positioning the work before making the next cut.

It is observed that the formed milling

Fig. 87 — This rigid setup, which includes two heavy duty vertical spindle cutter heads and a large indexing fixture, form mills fourteen teeth in twelve sprockets at one setting.



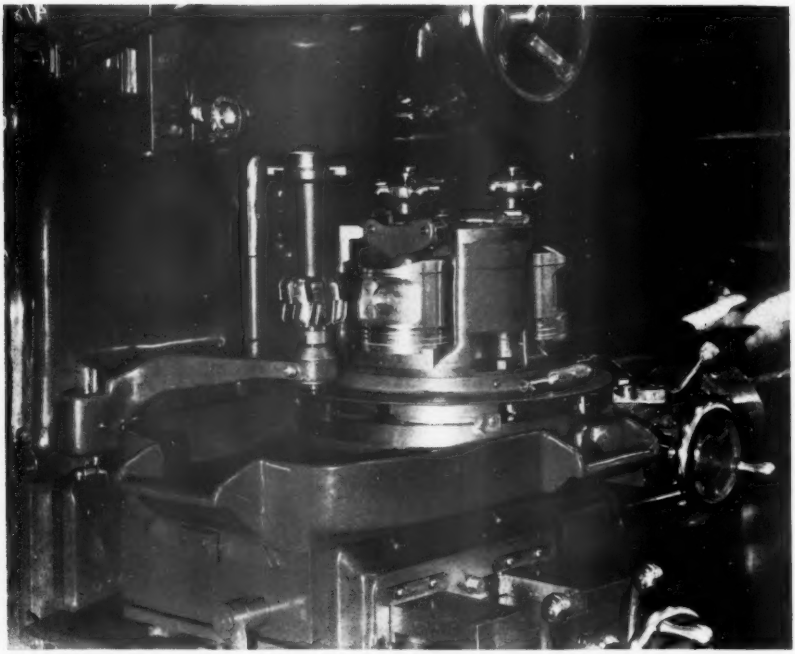


Fig. 88 — For milling side reliefs in aircraft piston heads, this standard vertical milling machine is equipped with a built-in rotary table which carries a 3-station loading fixture. This setup permits a continuous cycle of placing a piece of work, milling, removing and locating the next piece.

cutters remove the metal only between the teeth. The cutters do not "straddle" the teeth. The advantages in milling sprocket teeth by this method have been fully illustrated and described in this series under Figs. 55A and 55B, published in the October 1942 issue on pages 60 and 61.

Two spaces between the teeth are cut in one pass of the fixture. Another cut is made by a second cutting head which is concealed in the picture at the rear side of the machine. These large chain drive sprocket wheels are used in the assembly of important equipment used in the war.* A copious flow of a lubricating coolant is delivered on the cutters by spouts behind the housing of the machine.

*Much could be said on this subject, but due to war censorship it has been omitted.

Milling Relief Cuts in Aircraft Engine Pistons

This interesting operation is performed in the vertical standard milling machine shown in Fig. 88. The strength and rigidity of a heavy duty machine is necessary for this operation because the cut is wide, heavy and ¾" deep. An extra underarm carries a bearing that supports the lower end of the cutter arbor. Two formed milling cutters are used, each of which has one of its sides ground flat. The flat sides of the cutters are clamped together with their teeth alternated in the tooth spaces of the other cutter. The cutters are "keyed" on the arbor and clamped tightly together by a heavy nut seen just above the underarm bearing. The

(Continued on Page 181)

By Edward H. Doerger
American MonoRail Co.

Overhead Method of Material Handling

Tool and die shops are increasing efficiency by providing handling equipment for lifting and carrying operations—skilled employees thus being released for more production work.

This article is the first in a series describing the successful applications of material handling systems.

OVERHEAD handling systems are usually identified with large manufacturing plants having tremendous problems in transporting quantities of materials over great distances within a single factory. Problems of this type can and are efficiently handled by overhead methods, but many small shops could economically and practically operate similar equipment. With manpower critically short, especially skilled workmen who make up the bulk of the personnel in small shops, any time saving system which relieves these skilled men of unproductive jobs constitutes a saving in both time and money.

Just such an example can be found in the compactly arranged shop of the I. J. Frindt Co., Cleveland, Ohio, who keep at a minimum the time consumed in handling heavy die blocks through the use of overhead monorail handling equipment. While there is normally considerable movement of the heavier die blocks back and forth between departments, the overhead handling system, as installed, permits operators to place work directly in their machines without lifting or straining. Since every man in the shop is a skilled die sinker or toolmaker, the investment in labor saving equipment has paid big dividends by releasing these men from lifting and carrying operations. As shown in the diagram, Fig. 1, the entire system of tracks with interlock connections to the crane serving Wing B, speeds up passage of hoists carrying the blocks.

Blocks weighing up to two tons arrive by truck and are unloaded by chain hoists on a spur track extending through the shop door and out over the driveway as shown in Fig. 2 and Track F in the layout plan. Blocks are carried on chain hoists over Track A to the storage area on the extreme end, which is covered by branch tracks for access to the stored steel.

Spur Tracks for Machines

Since there is such a great deal of handling from one machine to another

during the early operations of sinking a die, branch tracks allow access to planers and vertical millers where the heavy work is done. Figure 3 shows the track switches with branches serving the large machines in Wing A.

In regular production, the heavy die blocks move from storage to the planers covered by Tracks C and D. Figure 4 shows an operator placing work on the bed. Note how the track extends above the machine to permit positioning of the block by the chain hoist, thereby eliminating manual handling entirely.

After completion of the planing operations, blocks are taken to the saw or drill press shown immediately adjacent to the planers. Then they move to Wing B for layout and back again over Track B to the heavy machine section for vertical milling. In Fig. 5 a die sinker is shown setting a block on the bed of his miller with the chain hoist. Little effort or time is required for this work, assuring accurate positioning and perfect safety throughout.

System is Flexible

This plant was originally contained in Wing A with Track A the only means of handling the blocks. Practically all the branch tracks were rearranged or added to the original system to provide for increased operation. Wing B was

Fig. 1 — Diagram of layout showing overhead monorail system installed in plant of the I. J. Frindt Co., Cleveland.

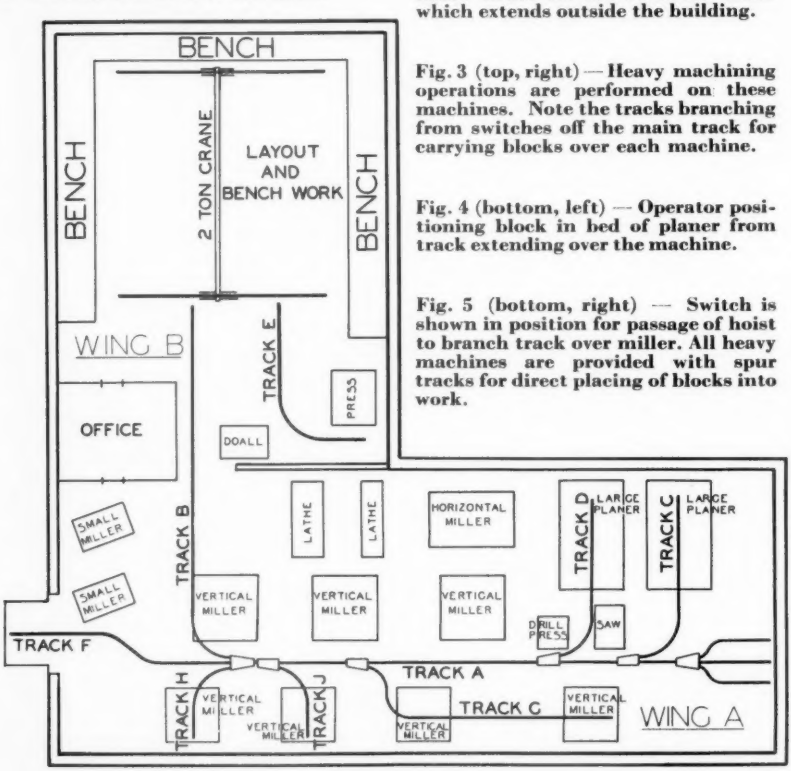
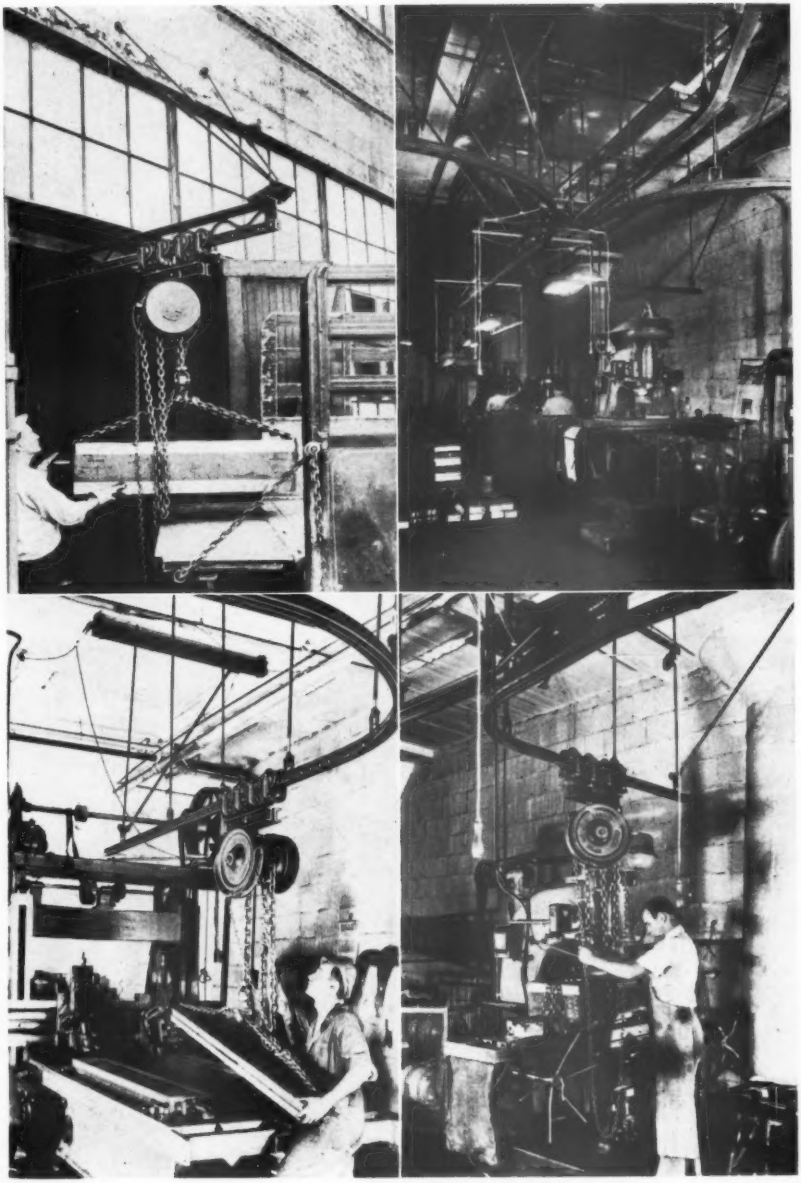


Fig. 2 (top, left) — Die blocks arrive in trucks and are unloaded by spur gear chain hoists on the monorail track which extends outside the building.

Fig. 3 (top, right) — Heavy machining operations are performed on these machines. Note the tracks branching from switches off the main track for carrying blocks over each machine.

Fig. 4 (bottom, left) — Operator positioning block in bed of planer from track extending over the machine.

Fig. 5 (bottom, right) — Switch is shown in position for passage of hoist to branch track over miller. All heavy machines are provided with spur tracks for direct placing of blocks into work.



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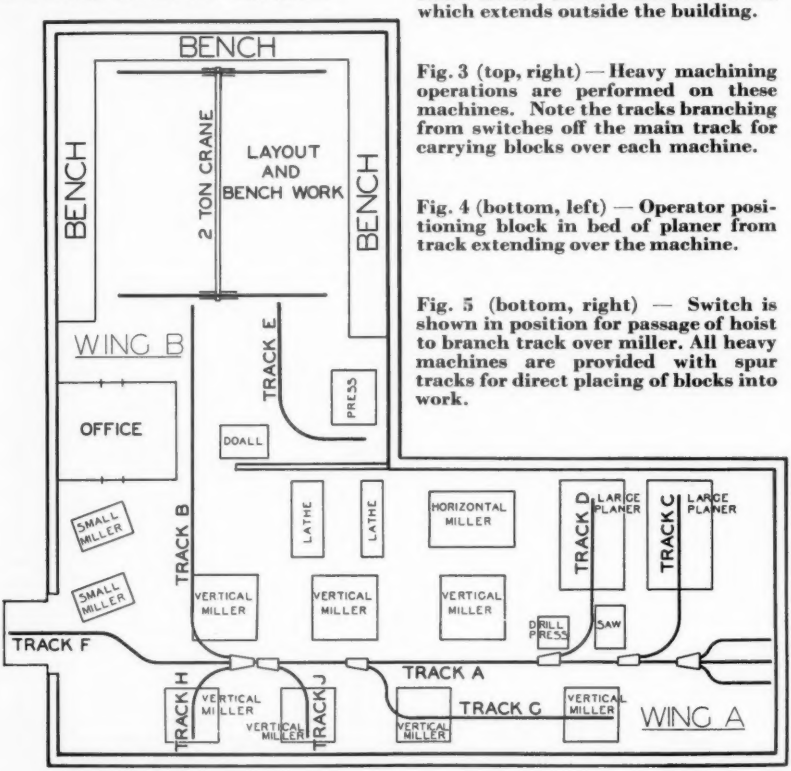

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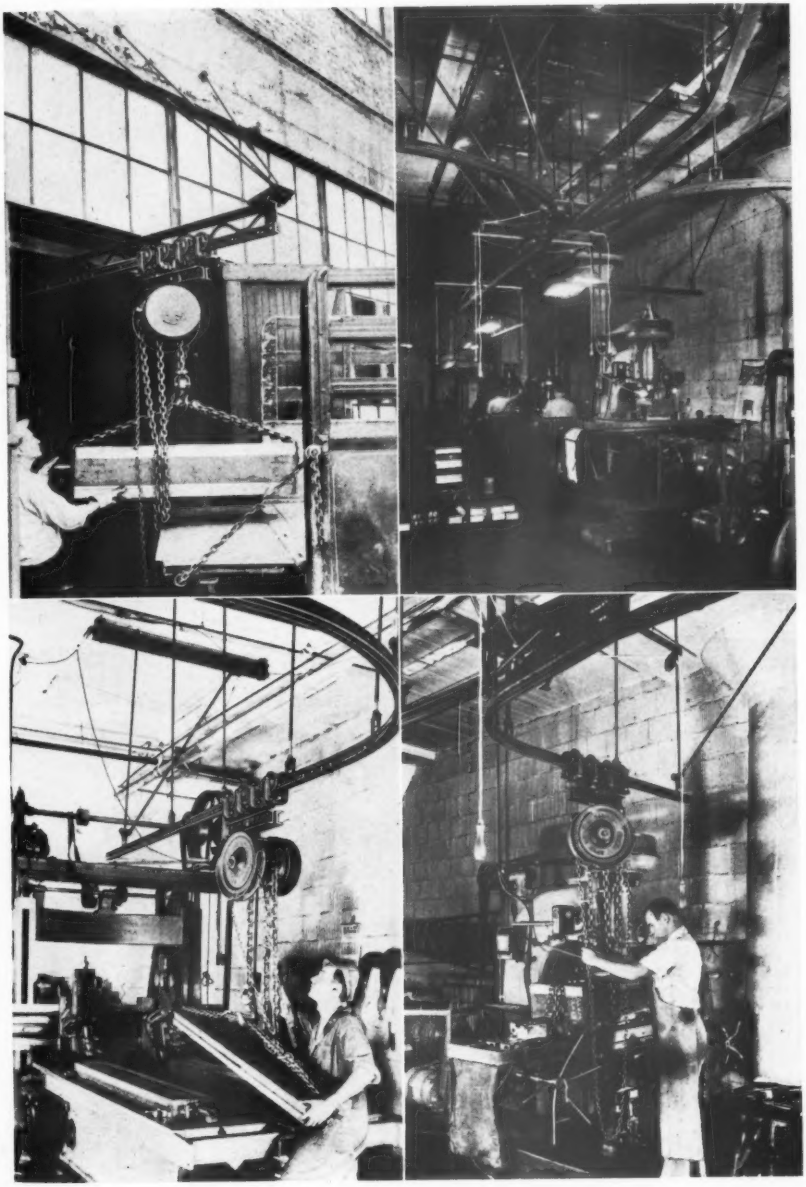


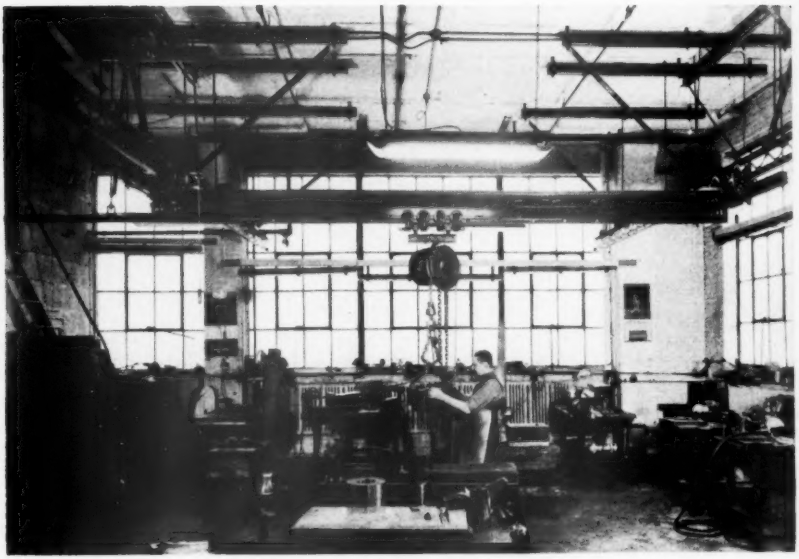


Fig. 6 — Two-ton crane in Wing B serving all the benches and portable tools in this aera. Crane connects with tracks on one side by means of interlocks.

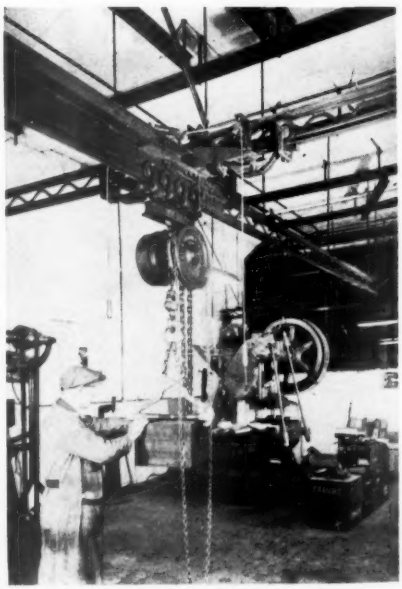
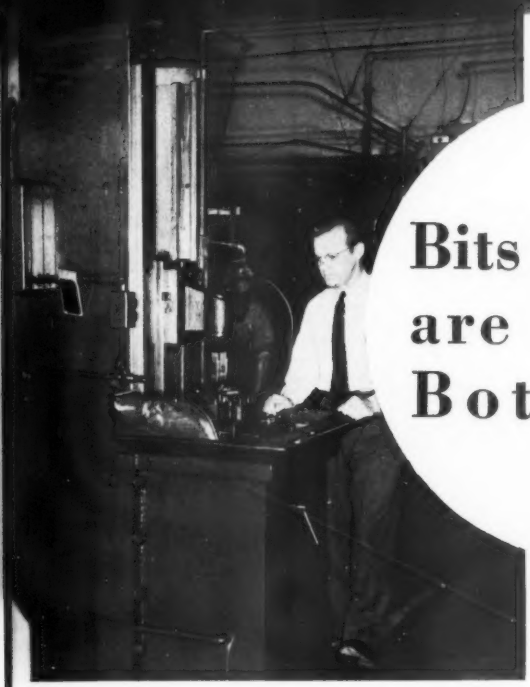


Fig. 7 — Operator moving trolley from crane over interlock connection to spur track serving the press.

originally served by Track B, but with the plant capacity nearly doubled with production of dies for aluminum forgings for the aircraft industry, it was found expedient to add the crane shown in Fig. 6. This crane, of two ton capacity, serves all the benches and portable tools in this area. Track E, the newest addition to the system, handles blocks from the crane by means of the interlock connection in Fig. 7, to the press or DoAll machine in this wing.

It will be noted that all the chain hoists shown in the illustrations are equipped with eight wheel trolleys. This heavy duty design distributes the load along the monorail so that no excessive unit load bears on any one point. Movement of two ton loads is, therefore, safe and easy throughout the system.



Bits and Pieces are Breaking Bottlenecks

IN the War Production Board's News Bureau files it was known as story "P1-No. 34" but to a Los Angeles tool company it meant the breaking of a bottleneck that was holding up production on mechanical hand tools for the armed services.

Milling of prongs of universal socket wrenches in two separate operations at a rate of 100 an hour was not only too slow, but tied up two machines, keeping them from other essential work. The obvious answer was to broach the prongs instead of milling them. There were no broaches available, however, and a new broach could not be obtained for six months to a year.

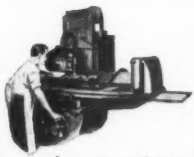
The bottleneck was cracked by "bits and pieces" of scrap designed and built into a vital machine tool—a 40" combination push, pull and surface broaching machine.

The firm's engineering department, working with its machine shop, designed a machine that could be built entirely from available scrap. A discarded hydraulic pump and valve taken from the scrap pile were completely disassembled, inspected and found usable. The worn out bearings were resurfaced with hard chrome plate, and here and there parts were replaced by home made substitutes. In addition to these parts the company was able to obtain a servicable motor, two pieces of Shelby tubing, one steel casting and boiler plate—all of which were utilized.

Within ninety days the machine was complete, installed and turning out universal socket wrenches three times as fast as they had previously been milled. The new "creation" not only did a better and more accurate job but was able to relieve pressure on other broaching machines by taking over part of their backlog of work.

This story from the production front by the industrial soldier is comparable to the ingenuity of the repair crews on Wake Island and Bataan who kept patched up planes in action by their individual resourcefulness.

To the Skeptic who hasn't yet tried the POR-OS-WAY wheel



A YEAR AGO we introduced to industry a new precision grinding wheel. We were confident, after three years' research and scores of actual trials on production work that this new wheel, Por-os-way, would produce 2 to 5 times more work per man per machine. And we said so. Our statement seemed incredible. But there was a war to be won so war plants by the score tried Por-os-way. They did not fully realize, then, that Por-os-way, being an entirely new kind of wheel, could not be limited by comparison with wheels they had been using. Skepticism is disappearing. Many operators now *know* that Por-os-way's patented honeycombed structure cools each grinding point between contacts, practically eliminating "burns" in vital war work. Many know that they can double or treble the depth of former cuts and grind in fewer passes of the wheel . . . have seen how the Por-os-way wheel holds its corner and resists "loading", reducing the number of dressings necessary. Many have proved to their own satisfaction that the life of a Por-os-way wheel is at least equal to or better than previous wheels, and know that Por-os-way can produce 2 to 5 times more work per man per machine. But even among Por-os-way's most enthusiastic users, some few are *still not pushing Por-os-way to the limit of its possibilities.* Give this wheel "the whole works." See for yourself it is all others say it is. Send at once for "Facts about Por-os-way," with a "prescription blank" for a trial, run to your requirements.

WAR PLANTS SAY, "Tell others what Por-os-way has done for us."

WAR PLANT A—Job: Surfacing oil-hardened, high-speed steel blanks on B & S grinder at 6200 SFPM.

Results: Por-os-way removed .050" in one pass, against .020" previously. Por-os-way wheel lasted 2½ times as long as former wheel, required no dressing, produced no burn, held shape and corner while grinding.

WAR PLANT B—Job: Grinding high-speed cutter tool steel on LeBlond No. 1 at 4750 R.P.M.

Results: Por-os-way increased production 300%. Held a true edge in grinding a complete gear cutter. No burning, no loading. Free cool cutting without dressing. Good finish.

2 TO 5 TIMES
MORE *WAR* PRODUCTION
PER MAN PER MACHINE

*T. M. Reg. U. S. Pat. Off.
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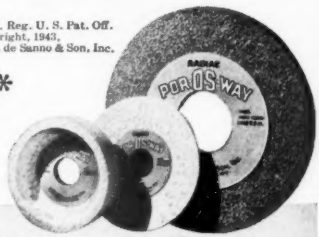

POR-OS-WAY* *a new* **RADIAC* PRODUCT**

A. P. DE SANNO & SON, INC.
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PHOENIXVILLE, PENNA.
Western Gateway to VALLEY FORGE

TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES

DRILLING TECHNIQUE

This is the fourth machining technique article in a series. They are written to be of the greatest possible value in training "green" operators and as a refresher course for experienced workers and department heads.

A DRILL is a tool generally formed by milling, or forging followed by milling, in a cylindrical piece of steel, two equal and diametrically opposite spiral grooves. The spiral grooves or flutes, as they are called, have the correct shape to form suitable cutting edges on the cone-shaped end, to provide channels for the free egress of chips and to permit the lubricant to get down to the cutting edges when the drill is working in a hole.

It is, all things considered, the most efficient tool used by mechanics, for in no other tool is the cutting surface so large in proportion to the cross sectional area of the body or part that is its real support.

Parts of a Drill

A drill may be divided into three principal parts—the *point*, the *body* and the *shank*. The cone-shaped surface at one end is called the *point*. The two spiral grooves running along opposite sides of the drill are known as *flutes*. They are shaped to do four things:

(1) They help form the proper cutting edges on the point.

(2) At their junction with the cutting edges they are so shaped as to curl the chip tightly within itself—so that it occupies minimum space.

(3) The flutes also form channels through which the chips escape.

(4) They also allow the lubricant to get down to the cutting edges.

The *dead center* is the sharp edge at the extreme tip end of the drill. It is formed by the intersection of the cone-shaped surfaces of the point. It should always be in the exact center of the axis of the drill.

The *lips* (sometimes called cutting lips) are the cutting edges of the drill. They are formed by the intersection of the flutes and the point. The *heel* is the portion of the point back of the lips.

A real cutting edge would not be formed if the surface of the point were a 90° angle to the plane of rotation. Rather the edge would be a square corner too blunt to penetrate. To give a real cutting edge to the lips, the surface of the point is ground away or "relieved" just back of the lips. This relief is called *lip clearance*.

The narrow strip between the flutes (Fig. 1) is called the *margin*. It is the full diameter of the drill and extends the entire length of the flute. Its surface is part of a cylinder which is interrupted by the flutes and by what is known as *body clearance*. The body clearance is of less diameter than the margin, reducing friction between the drill and the walls of the hole. This clearance is necessary not only to reduce power but also because the friction might draw the temper of the drill or cause it to bind in the hole. The margin, however, insures the hole being of accurate size.

The *web* is the column which separates the flutes. It is the "back bone" of the drill. It gradually increases in thickness toward the shank to give rigidity to the drill.

Drills are not of the same diameter from end to end, but decrease in diameter from the point towards the shank by an amount varying from .0005 to .00075 inches per inch of length. The purpose of this *back taper* or longitudinal clearance is to prevent the drill from binding.

The *shank* of a drill is the end which fits into the socket or spindle or chuck of the drilling machine. There are a number of different types, the most common of which are illustrated in Fig. 3.

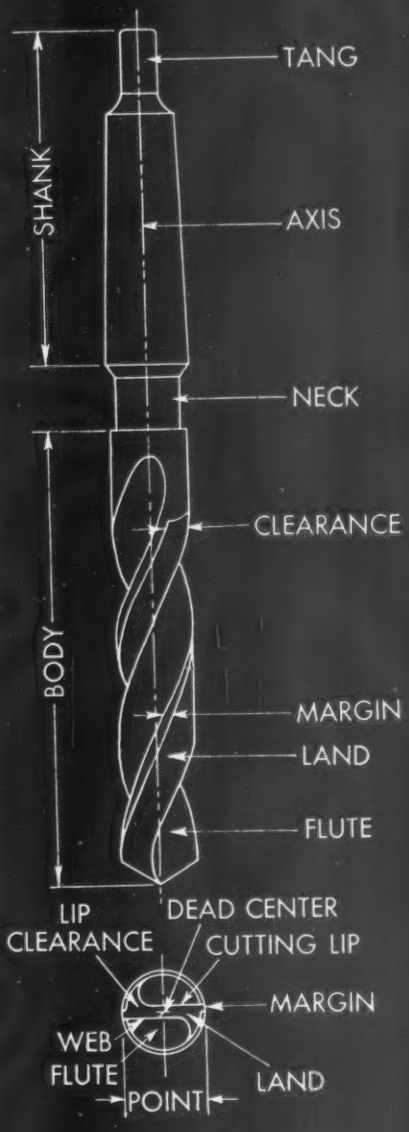
Points on Drill Grinding

The majority of the difficulties encountered in drilling arise from faulty grinding either of the point or the lip clearance. When grinding a drill, three things must be considered:

(a) Lip clearance.
(b) The length and angle of the lips.
(c) The location of the point and dead center in relation to the axis or center of the drill.

Lip clearance is the "relief" which is given the cutting edges in order to allow them to enter the metal without interference. Without this clearance it would

DRILL NOMENCLATURE



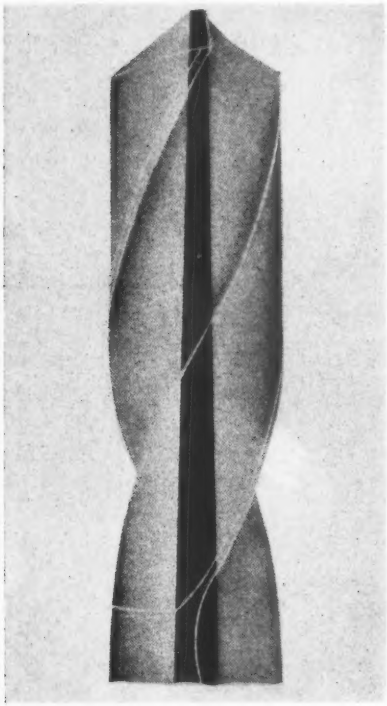


Fig. 2 — Diagrammatic illustration of a drill web. It is the metal column which separates the flutes.

be impossible for the drill to cut into a piece of steel. Fig. 4 illustrates a drill without clearance. Surface "S" of this drill would always be in contact with the metal and would effectively prevent the cutting edge from biting further into the metal. Such a drill would merely rub without penetrating. Therefore, the

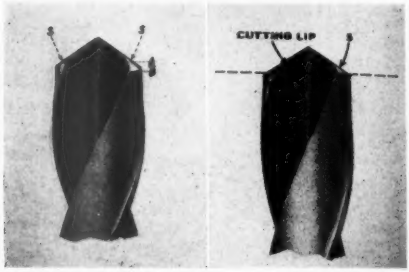


Fig. 4 (Right) — showing a drill point without any clearance. Note that both the cutting lip and the heel "S" are in the same plane. Left — proper lip clearance. Note how much lower the heel line is than the cutting lip.

surface "S" back of the lips must be ground. The effectiveness and life of a drill depend to a large degree on the correct forming of this clearance.

The *heel* (the surface of the point

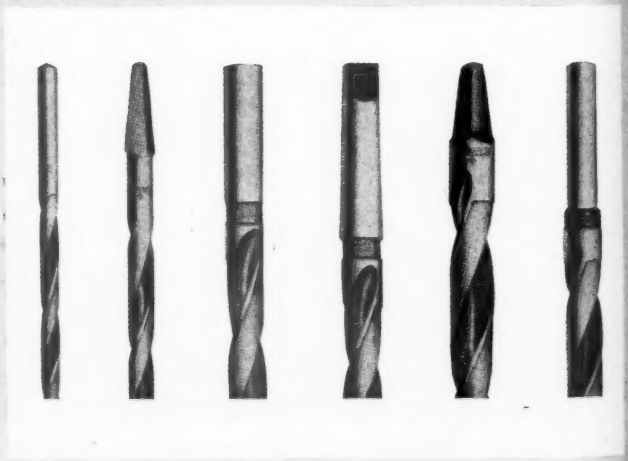


Fig. 3 — Six typical drill shanks.

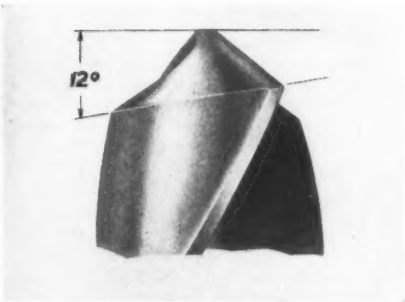


Fig. 5 — Showing the proper way to grind the surface back of the cutting lip. The angle indicated is the angle at the circumference of the drill. This angle should be increased as the center of the drill is approached.

back of the cutting lip) should be ground away from the cutting lip at an angle of about 12° at the circumference of the drill as shown in Fig. 5. This angle of lip clearance should be gradually increased as the center of the drill is approached until the line across the dead center of the drill stands at an angle with the cutting edge of not less than 120° or it may be as much as 135°. For heavy feeds in soft material, the lip clearance may sometimes be safely increased to 15°. Care should be taken,

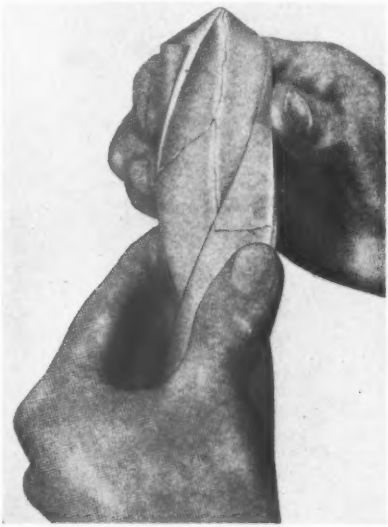


Fig. 7 — Here the drill was given insufficient lip clearance. As a result there ceased to be any cutting edges whatsoever and, as the feed pressure was applied, it split up the center.

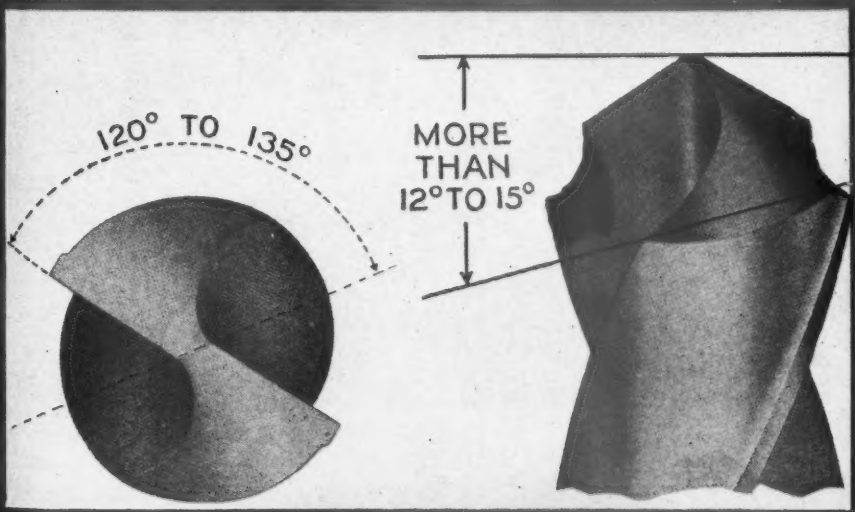


Fig. 6 (Left) — illustrates how to gauge lip clearance angle. Right — results of giving a drill too great lip clearance. The edges of the cutting lips have broken down because of insufficient support.

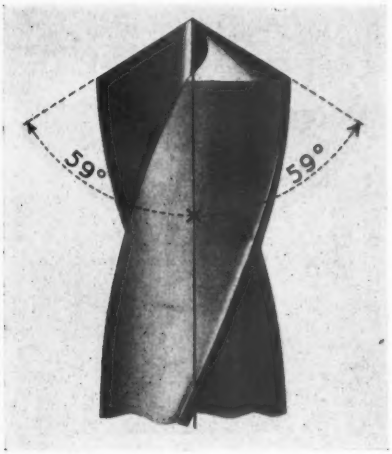


Fig. 8 — Correctly ground lips.

however, to see that the angle at the center of the drill is increased proportionately.

Fig. 9. — An example of a drill where the angles of the two lips vary. The cutting edge on the left is doing most of the work.

If the angle of lip clearance is too great, the edges of the cutting lip will break down (as in Fig. 6), because they will not have sufficient backing to support them—just as a razor edge breaks down if used for cutting tin, because it is too thin and lacks sufficient support to withstand the strain.

If insufficient clearance, the drill refuses to penetrate and may result in splitting the drill up the center (Fig. 7).

After grinding the proper lip clearance it is necessary to check that:

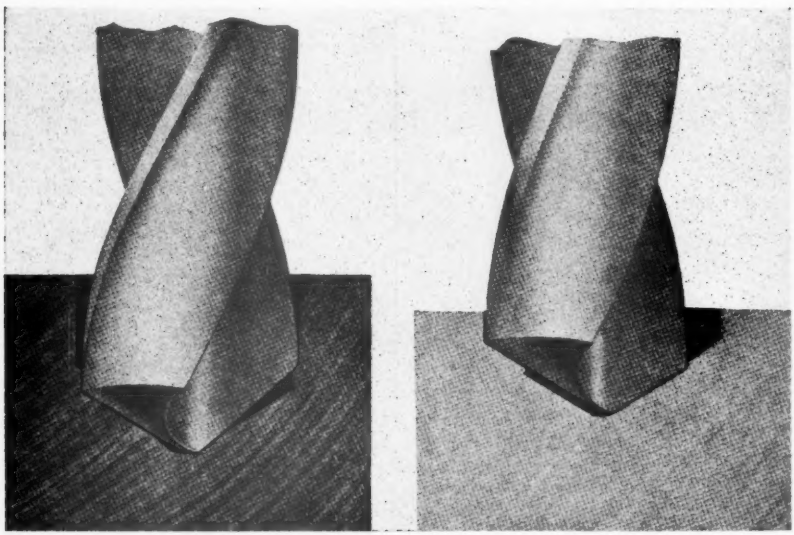
(a) The two lips are the same length.

(b) The angles of both lips (in relation to the axis of the drill) are equal and correct—59° is recommended for ordinary purposes (Fig. 8).

(c) If (a) and (b) are correct the third requirement, central location of the point, is also correct.

If the point is in the center but there are different angles on the cutting edges (Fig. 9), the drill will bind on one side.

Fig. 10 — An example where the length of the lips are different. Note how large the hole is. This will cause considerable drill and spindle wear.



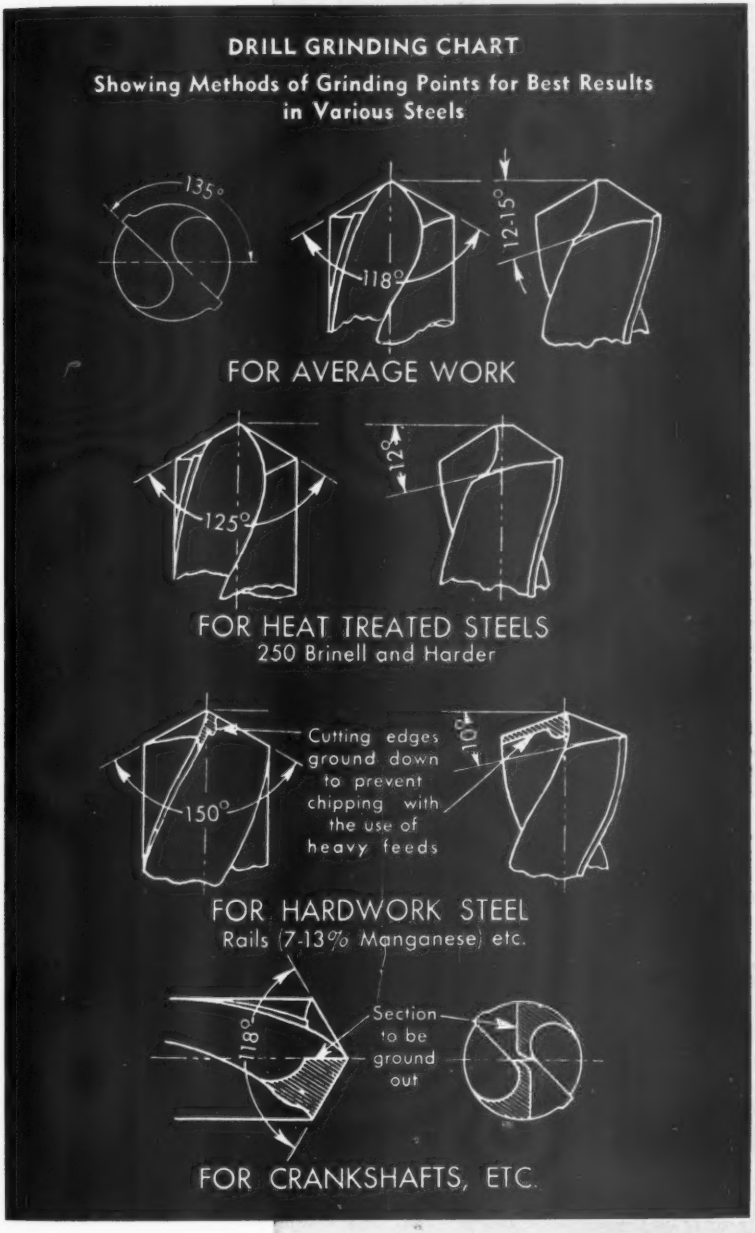

DRILL GRINDING CHART
Showing Methods of Grinding Points for Best Results in Various Steels
135°
118°
12-15°
FOR AVERAGE WORK
125°
12°
FOR HEAT TREATED STEELS
250 Brinell and Harder
150°
Cutting edges ground down to prevent chipping with the use of heavy feeds
10°
FOR HARDWORK STEEL
Rails (7-13% Manganese) etc.
118°
Section to be ground out
FOR CRANKSHAFTS, ETC.

Fig. 11

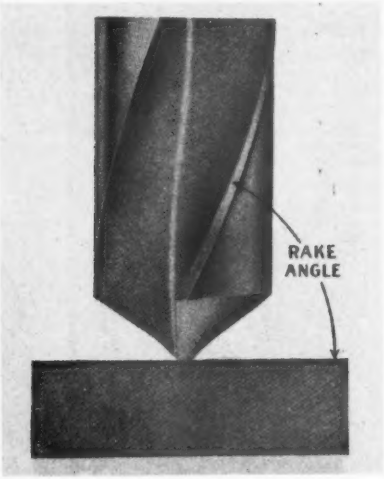


Fig. 12 — The rake angle is the angle of the flute in relation to the work.

Only one lip or cutting edge will do the work with resultant wear on this cutting edge, and the hole will be larger than the drill. Or if there are equal angles on the cutting edges but the lips are of different lengths, the point and lip will be off center. The effect of this condition is the same as though you put the axle of a wheel any place but in the exact center of the wheel (Fig. 10). The resultant strain on the press is tremendous and causes weaving or wobbling of the spindle and rapid wear on the drill.

Another part of the drill which performs an important function is the *rake angle*. This angle is the angle of the flute in relation to the work—shown in Fig. 12. If the rake angle were 90° or more it would not make a good cutting edge. If it is ground with too small an angle it makes the cutting edge so thin it breaks. The rake angle also partially governs the tightness with which the chips curl and therefore the amount of space which the chips occupy. In standard drilling practice the rake angle established by the manufacturer is correct and should not be altered.

When grinding a drill, never plunge it in cold water. Nothing will *"check"* (fill full of small cracks) a drill quicker than to put it in cold water after it has become heated while working or in grinding.

Drill Speeds and Feeds

When we refer to the *speed* of a drill, we mean the speed at the circumference, called the *peripheral speed*. Speed refers to the distance the drill would travel if it were laid on its side and rolled. Thus a drill with a peripheral speed of 30 feet a minute would roll 30 feet a minute.

Except under certain rather rare conditions, a drill does not pull itself into the work like a corkscrew—it requires constant pressure or *feed* behind it to advance it. This advance (measured in fractions of an inch per revolution) is called *feed*. Feed *pressure* however is the pressure required to maintain the feed.

Opinions differ regarding the correct speed and feed. There are no hard and fast rules that can be given. The suggestions on the next page should be considered merely as guides. The correct speed and feed can be determined only by good sound judgment in each particular case.

In starting a drill, bring it down to the work by hand feed until it centers itself in the work. Then throw in your power feed. Composition and hardness of material, depth of hole, lubricant, type machine used, condition of machine, set-up, point-grinding, quality of holes desired and many other items influence speed and feed.

Starting feed is governed by size of drill and material. A good general rule is to use a feed of .001″ to .002″ per revolution for drills smaller than ⅛″; .002″ to .004″ for drills ⅛″ to ¼″; .004″ to .007″ for drills ¼″ to ½″; .007″ to .015″ for drills ½″ to 1″; and .015″ to .025″ for drills larger than 1″.

It is a good idea to start the drill with a moderate speed and feed, increasing either one or both after observing the condition of the drill.

Indication of Too Much Feed

If a drill *chips out* at the cutting edge,

it is a sure indication of too heavy a feed or too much lip clearance. A drill which splits up the web is also evidence of too much feed for the amount of lip clearance—or both. Too much lip clearance at the center or at any point on the lip will cause the cutting lips to chip.

Indication of Too Much Speed

High speeds in cast iron tend to wear away the margin. When the extreme outer corners of the cutting edges wear away too rapidly, it is evidence of too much speed.

In general, a high speed and light feed is recommended. It is better to err on the side of too much speed than too much feed except for cast iron where the nature of the material permits an unusually heavy feed. The speed can be increased to the point where the outside corners commence to show signs of wearing away. It can then be slightly reduced and maintained at this reduced figure.

Lubrication

Lubricants have many functions, several of which are as follows:

(a) To cool both the cutting edges of the tool and the work being machined. This can be done by directing as large a volume of the coolant as possible on the cutting edges. On thin walled work it often helps to allow a large column to flow onto and around the piece.

(b) To lubricate the chips. This aids in chip clearance.

(c) To force the chips back from the cutting edges and out the flutes of oil feeding drills. High oil pressure will accomplish this most efficiently.

(d) To improve the finish of the work. The selection and proper application of the lubricant will materially influence the machined finish.

Lubrication problems should be referred to a reputable manufacturer of cutting oils. The following list of lubricants are only suggestions:

Aluminum and its alloys: Soluble oil, kerosene and lard oil compounds, light viscous neutral oil, kerosene and soluble oil mixtures.

SUGGESTED SPEEDS FOR HIGH SPEED DRILLS

	Speed in FPM
Aluminum and Its Alloys	200-300
Bakelite	100-150
Brass and Bronze, Ordinary	200-300
Bronze, High Tensile	70-100
Cast Iron, Soft	100-150
Cast Iron, Hard	70-100
Cast Iron, Chilled	30-40
Malleable Iron	80-90
Magnesium and Its Alloys	250-400
Monel Metal	40-50
Steel Machinery .2 to .3C	80-110
Steel, Annealed .4 to .5C	60-70
Steel, Tool, 1.2C	50-60
Steel Forgings	50-60
Steel, Alloy	50-70
Steel, Stainless, Free Machining	60-70
Steel, Stainless, Hard	30-40
Slate, Marble and Stone	15-25
Wood	300-400

Carbon steel drills should be run at speeds of from 40 to 50% of those given above.

Brass: Dry, soluble oil, kerosene and lard oil compounds, light non-viscous neutral oil.

Copper: Soluble oil, winter strained lard oil, Oleic acid compounds.

Cast Iron: Dry or with a jet of compressed air for a cooling medium.

Malleable Iron: Soluble oil, non-viscous neutral oil.

Monel Metal: Soluble oil, sulfurized mineral oil.

Steel, ordinary: Soluble oil, sulfurized oil, high E.P. Value mineral oil.

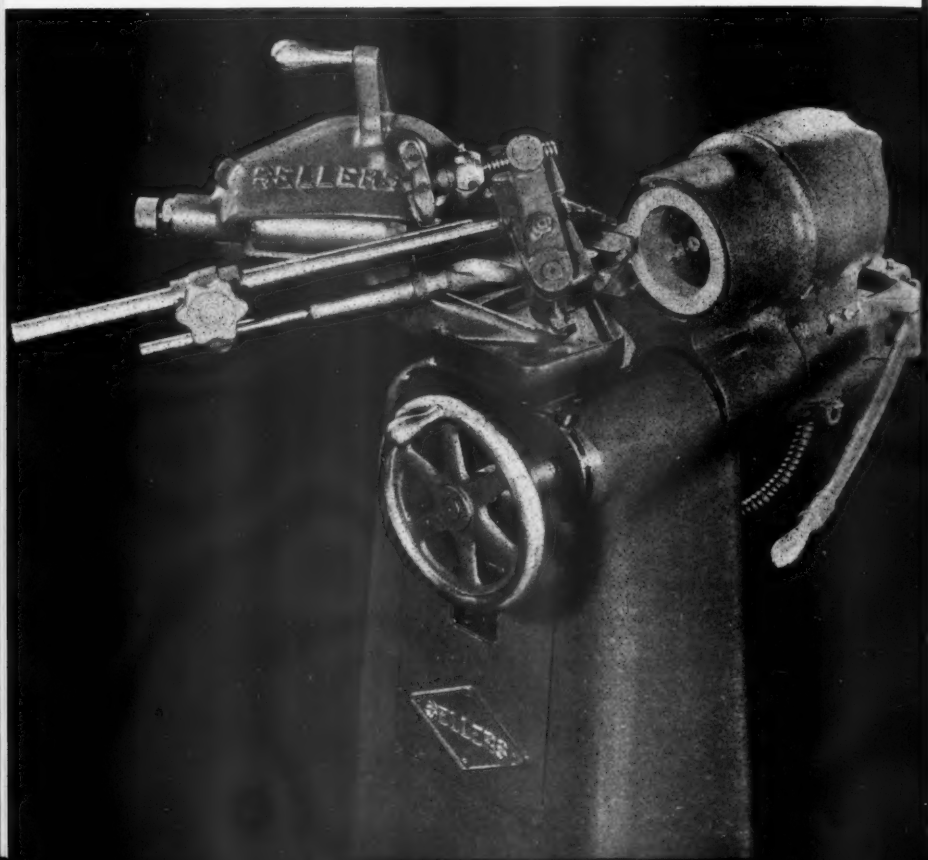
Steel, very hard and refractory: Soluble oil, sulfurized oil, turpentine.

Drilling Hard Materials

Very often, even after grinding a drill properly and increasing the speed to the extreme limit, the drill still fails to penetrate. This is usually caused by a hard spot in the material itself. It can be remedied or at least helped by liberal application of turpentine directly to the work.

Another method is to reduce the entering angle of the lips usually called the "rake angle", so as to permit the use of a heavy feed pressure. If a heavy feed pressure were used without first grinding the sharp angles off the lips (called "raking") as in Fig. 14, the drill would

Fig. 13 — A typical drill grinder. Attachments are also available that can be used on any standard grinder.



chip on the lips. This removal of the sharp angle on the lips must be done with extreme care and judgment, or the drill will have to be reground throughout. A good rule to follow is "the harder the metal the lighter the feed and slower the speed."

Drilling Small Holes

In drilling holes of small diameter, unless the feed and speed are given unusually careful attention, the danger of breakage is very great, especially at the moment the point of the drill breaks through the other side of the work. When using a hand feed the danger of breakage is greatest since it is difficult to regulate the degree of pressure exactly. When drilling with small drills it is better to use too much speed than not enough, and to keep the feed light.

Drilling Brass

Owing to the softness of this material, a heavier feed than for the harder materials may be used, especially in automatic machines, in order to insure the chips having sufficient body to follow the flutes out of the hole. The form of point illustrated in Fig. 14 is also efficient for drilling soft materials such as brass or any material where the normal point has a tendency to *hog in* or *grab*.

Drilling on Automatics

When drilling holes on automatics where they do not exceed four drill-di-

Fig. 14 — A specially ground drill for hard materials.

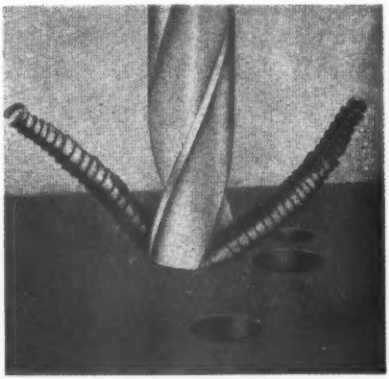


Fig. 15 — An illustration of a properly rolled chip. Note how compactly these chips fit into each other.

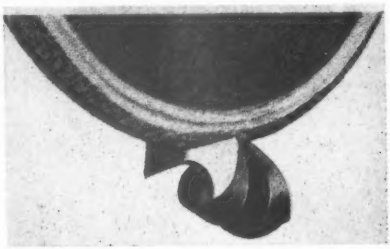
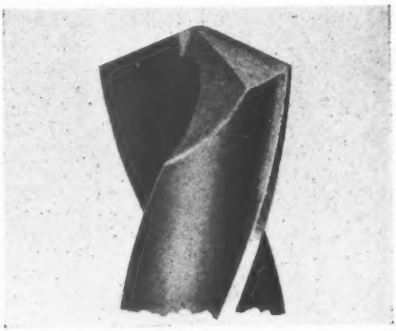


Fig. 16 — One method used to thin a web. A round faced emery wheel is used.

Fig. 17 — This method of web thinning is known as notched point thinning and is done with a sharp cornered emery wheel.



ameters in depth it is recommended that a high speed and light feed be used with a large volume of coolant. Always endeavor in automatic drilling to get a small, compactly rolled chip (Fig. 15) and if possible keep it unbroken the entire depth of the hole, as such a chip feeds out through the flutes most easily.

Web Thinning

Due to the gradual increase in the thickness of the web as a drill is pointed back, it is necessary to thin the web at the point to obtain maximum results. This operation may be done in several ways. Figure 16 illustrates the method commonly used. In this case the thinning is done with a round-faced emery wheel. Figure 17 illustrates what is known as the *notched point* thinning and is done with a sharp cornered hard emery wheel. This type of thinning is especially adapted for hand feed such as turret lathe, screw machine and similar work. Correct web thinning is just as important as point grinding in securing satisfactory performance from a drill.

Common Errors and Their Correction

Broken Tangs

Broken tangs result from a variety of causes—they may be traced to the use of badly mutilated sockets, to the use of drills whose shanks are so "banged up" that they do not fit snugly into the socket, or to the use of drills with badly mutilated tangs. Although the tang of the drill is designed to carry a portion of the driving strain, the tapered fit between the shank of the drill and the wall of the socket should carry a large share of this strain. As a result, if either the inner wall of the socket or the surface of the shank is mutilated, a perfect fit is impossible. Under such conditions the whole driving strain is thrown on the tang. Often the tang breaks, through no fault of its own, but rather through faulty treatment of either the drill or the socket. Before inserting a drill rub off the shank to make certain it is smooth and free from grit. Also inspect the inside of the socket to be sure it is in the same condition.

Proper "Drift-Out"

In drifting a drill out of a socket never use anything but a drift. The use of such makeshifts as files or wedges is likely to permanently injure either the drill or socket or both. In removing the drill from the spindle or socket, take great care that the point or tip does not hit the table of the press or the work. It is well to have a bit of wood handy onto which the drill can drop as you drift it out.

Proper Inserting

In inserting a drill into the socket, never use a machinist's hammer, as this dulls the tip of the drill and nicks the cutting edges. Always use a material considerably softer than the drill itself —such as a lead or rawhide hammer.

Machine Rigidity

One of the most common causes of drill breakage is lack of rigidity in the press or in the work. Drill presses which are too weak to resist the feed pressure without springing, due either to faulty design of the table or of the feeding parts, and drill presses having lost motion in the spindle, invite breakage because the sudden release of the resistance to the feed pressure when the point breaks through the far side of the work causes the lips to bite too deeply into the work. This causes the lips to catch and sufficient strain results to break the drill.

Work Rigidity

The same results come about from faulty setting up of the work. Underneath the drill the work should be absolutely rigid and free from spring. The work should never be held in the hand. It should be rigidly clamped to the table of the press. In production work the use of properly designed drill jigs is important. A 24-page booklet covering modern designs for drill jigs is available through The TOOL & DIE Journal.

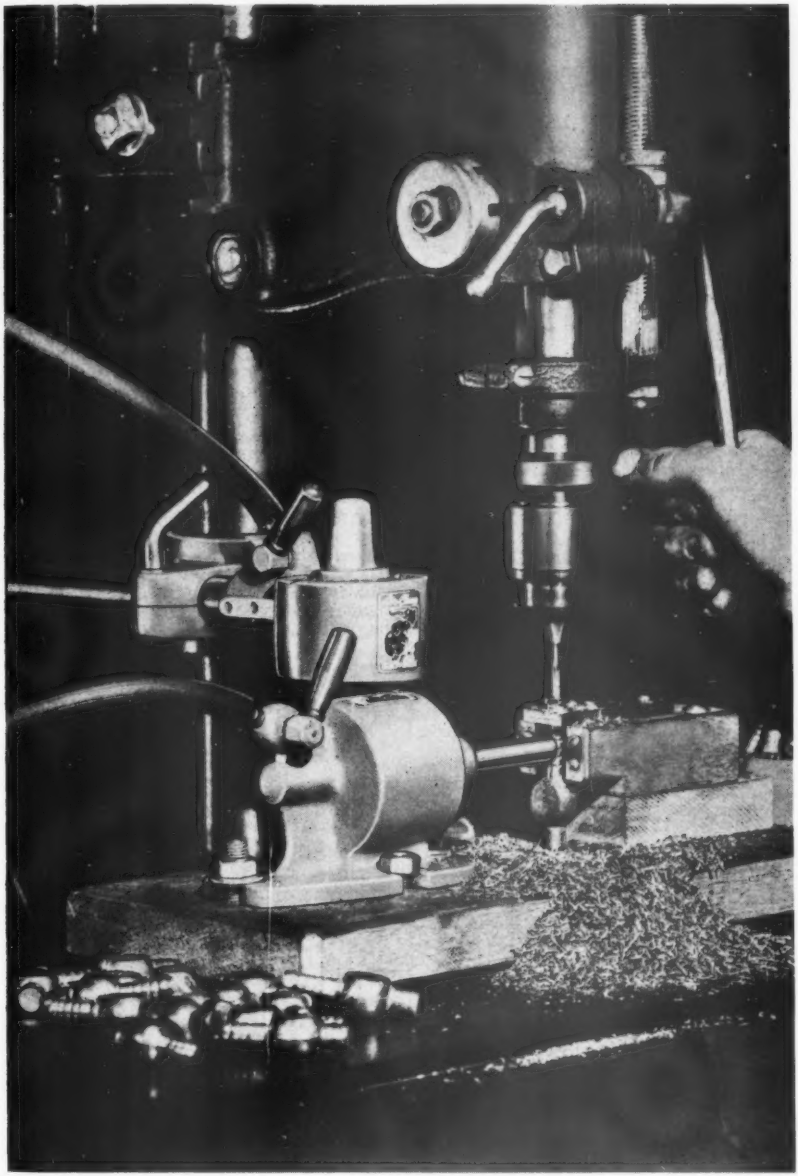


Fig. 18 — Rigidity is most important in proper drilling. Illustrated is a new type of air clamp for use in production operations. Other standard holding devices are toggle clamps, vises and indexing units.

DRILL TROUBLE

EFFECT	CORRECTION
Drill breaks.	Check work and table for rigidity. Increase speed or decrease speed; both are causes for drill breakage. Dullness of the drill or too little lip clearance will result in breakage.
Outer corners of cutting edges break down.	Decrease speed. This is almost always the result of too high a speed. It can also be caused by insufficient or the wrong lubricant.
Lips or cutting edges break down.	Decrease the feed pressure. This may be a sign of too much lip clearance for the material being drilled.
Chipping or checking of high speed drills.	This is caused by too much feed or by rapid heating and cooling of the drill when working or grinding. It is corrected by either reducing the feed pressure or by an increased volume of coolant. Never plunge a drill in cold water when grinding it. This will always cause checking.
Drill requires more feed pressure than normally.	Caused by increase in thickness of the web. A web-thinning operation is necessary.
A change in the nature of the chips in a drilling operation.	This is usually caused by the changing condition of the drill such as dulling or chipping. It is also noticed when the material being drilled is of varying degrees of hardness.
Only one lip is performing a cutting operation.	This results from unequal angles or lengths of the cutting lips. The drill must be reground properly.
The hole drills out too large.	Check the angle of the drill or length of the cutting edges. If the angles of the two lips vary or if their lengths are different, a larger hole than desired always results. If both the angles and lengths are correct, check for wear in the jig bushing or machine spindle.
Drill splits up the center.	Results from too great a feed. Reduce the feed first. Also check the lip clearance since too little clearance will result in splitting.

CHECK CHART

EFFECT	CORRECTION
Finished hole has rough surface.	A number of things can cause hole roughness. For precision work it is important to check each of the following points: use a sharp drill only; be sure it is ground properly; use the correct lubricant with a sufficient volume; be sure the setup is the best possible for the necessary accuracy and quantity of pieces to be drilled. All of these items can be correct but if too great a feed is used the hole will be rough. It is best to use a high speed and a slow feed.
Drill breaks when coming through the work.	Test the press and work for rigidity and alignment. The breaking is caused by the spring or backlash in the press or work.
Outer corner of cutting edges break when drilling hard material.	A turpentine lubricant will frequently help this condition. It is also wise to reduce the spindle speed.
The drill breaks when drilling brass, wood or other soft materials.	This is caused by chips clogging up the flutes. It can be corrected by using a properly designed drill for soft materials and increasing the speed.
Drill grabs in the work.	Check machine spindles and bearings.
Drill tang breaks.	This is usually caused by nicks, dirt or burs on the taper shank or a worn-out socket. By reaming the old socket or using a new one and by being sure the taper shank fits perfectly, the danger of tang breakage may be eliminated.
Chipping of margin.	An oversized jig bushing will cause chipping so select the proper size drill jig bushing.
A sharp drill will not cut.	Allow sufficient clearance back of the cutting edges.
Drill wears rapidly.	Increase the volume of coolant since this is an indication of a lack of lubrication. May be necessary to increase the body clearance to allow the lubricant to reach the point.

EFFECT	CORRECTION
When drilling certain materials, drill lacks cutting efficiency.	Most drills are furnished with a 59° point. But when drilling harder than usual materials the angle should be increased. For example, a point-angle of 75° is recommended for manganese steel, while for wood and fibre a 30° point-angle is best.
Cutting edges become either convex or concave.	If the point-angle is changed appreciably, it may be necessary to grind the flutes of the drill in order to produce straight cutting edges.
Drill point is weak.	Caused by too little web. As a general rule, a web thickness at the point of approximately 12½% (⅛) of the drill diameter is recommended.

We are indebted to the Cleveland Twist Drill Co., Republic Steel Corp., Chicago-Latrobe Twist Drill Works, Whitman and Barnes Co., Sellers Co., Mead Specialties Co., Delta Mfg. Co., and others who provided illustrations and textual data.

REPRINTS AVAILABLE

The four articles thus far published in the Training for Victory section are:

Grinding Technique
Turning Technique
Milling Technique
Drilling Technique

They have been reprinted to meet the tremendous demand from war production training classes, department heads, government officials and machine operators. The supply of Grinding Technique is exhausted but the others are still obtainable for a small handling charge. When ordering reprints, please designate the number of copies of each article desired. Address requests to Reprint Division, THE TOOL & DIE JOURNAL, 2460 Fairmount Boulevard, Cleveland, Ohio.

TDM Industry Problems Discussed

THE Chicago Chapter of the Special Tool, Die, Machine Shop Institute (The Tool and Die Industry) began its 1943 series of monthly meetings January 26. An overflow crowd was in attendance to hear the principal speaker, George J. Huebner, Chief of the Tooling Section of the WPB's Smaller War Plants Division. Mr. Huebner, the Publisher and Editor of The TOOL & DIE Journal, has been on leave from the magazine since September 11, 1941.

The talk covered many of the current problems foremost in the minds of all business men and particularly the part that smaller plants—less than 500 employees—will play in our war effort. Mr. Huebner said: "It goes without saying that the war has brought many very difficult problems to Washington for solution. One that has been recently discussed, perhaps more than any other, is that of the participation of smaller businesses and war plants in the war effort. Figures have been made public from time to time indicating that a large percentage of the total volume of war orders has gone to a few of America's largest producers. In most instances additional orders were placed with the same companies even though huge backlogs had accumulated.

"It certainly is not a sound condition to have small businesses eliminated from war production participation. However, there are many angles to consider and the Smaller War Plants Corporation and its Division of the same name are succeeding in presenting to the Army, Navy and other procurement agencies the desirability and the absolute need for bringing more of these smaller war plants into the picture.

"During November and December alone seven supply services of the War Department awarded 43,056 supply contracts totaling $846,000,000 to plants employing between five and 500 persons. These contracts account for 24 percent of the total dollar volume of all contracts awarded by these services during these two months. Additional subcontracts were distributed by the Army among 3,274 firms with a total spending of $151,500,000.

"The Air Force procurement officers at Wright Field in Dayton, Ohio, have placed during November and December a total of $50,300,000 among 733 firms employing less than 500 wage-earners.

This business is increasing steadily.

"The credit for the distribution of this total of $1,047,800,000 of war contracts to small plants is due to the full support being given by the procurement agencies of the Army to the principles established by the Smaller War Plants Division, under the directorship of Lou E. Holland."

Manpower is another serious problem for both industry and the Government. He went on to say: "The drafting of your skilled men has been, and still is, a serious problem for you. The War Manpower Commission, before it took over the Selective Service System, recognized this by making a die maker the No. 1 unreplaceable man and the tool maker No. 4."

But Mr. Huebner cautioned his audience to only ask deferment for absolutely essential men as a flood of unjustified requests for deferment operates to deprive those who really are entitled to consideration. For a solution to this problem Mr. Huebner told about the new manning tables which are favored by the Manpower Commission.

"These tables are intended to provide for the orderly induction of employees, workers being classified according to age, characteristics of jobs and time needed for training replacements. There are also columns in which you enter the period of time in which you will be able to replace the prospective inductee. These provide for periods from 'one month' to 'over 12 months.'

"The regional director of the War Manpower Commission has Form No. 500 on which application is made if it is of advantage to you to apply this method to your shop personnel. There is more to the plan, including the filing of occupational deferment Form 42A. While this method does not guarantee automatic deferment, it seems to me that it is one other way in which draft boards may become better acquainted with your labor problems."

In speaking of the Tool and Die Industry and what the future holds in store he went on to say: "It has been very gratifying to me to see how your Division here in Chicago and the entire Industry have responded to the ever expanding tooling requirements of production. It is my conviction that no industry which has accomplished so much has asked the Government for so little. If expansion were required and Government funds were not available, many of you provided *your* own. If new machine tools were not to be had at times, you took the used ones, rebuilt them and still turned out work to specified tolerances.

"From all the larger industrial areas I hear that hundreds of new tool shops and die shops have sprung into being. I have seen men shake their heads over that and forecast dire consequences.

"As a matter of fact, it typifies American enterprise, Free Enterprise. The opportunity which a man in America has, to go into business for himself, exists similarly in *no* other country. It has made American industrial supremacy what it is today. Free enterprise must not be taken from us because it is a right just as vital to the life of the American People as are those proclaimed in the 'Bill of Rights' which comprise the first ten amendments to the Constitution and include the Freedoms of Worship, Speech and Press.

"Vice President Wallace, who is one of our most active post-war planners, says that 'we can have full employment without destroying private initiative, private capital, or private enterprise.'

"There are well informed men in all walks of life who are very much concerned about that.

"He says further that 'the more private enterprise succeeds in maintaining full employment the less Government spending will be required but that Government must accept the major responsibility for filling whatever gaps business leaves.'

"To speak of American Industry is to think of mass production. To think of mass production is to think of precision tooling. No one can exist without the other.

"There is no industrial group that more perfectly illustrates the opportunities which exist under Free Enterprise than the tool and die and gage shops, and, in fact, all those plants which make

(Continued on Page 189)

By Glen H. Howell
Chief Engineer
Drive-All Mfg. Co.

The Application of Unit Drives to Machine Tools

This is the first of two articles which will take up the advantages of having machines equipped with unit drives.

TODAY, as never before in the span of its history, American industry is faced with a problem of expansion that is straining the ingenuity of the best minds that can be applied to the task. Today's production must be twice that of yesterday's, and tomorrow's must be twice today's. Coupling this with the fact of unavailability of materials and labor for erecting more buildings and building more machines can lead to but one set of conclusions:

1. Present resources must be used to better advantage.
2. Productive output per man-hour and per square foot of plant area must be increased.
3. Efficiency of both workers and machines must be raised.

The accomplishment of these objectives, as far as is in his power, should be the goal of every person in the machine tool industry, and for that reason the study and application of unit drives to the thousands of tools still driven by overhead belting is particularly important.

To declare that the machine tool industry as a whole foresaw the present emergency and took the necessary steps to be ready for it would be to give industry credit for prophetic vision that even the boldest would hesitate to claim. This fact, however, must be recognized and properly accredited; transmission experts and plant layout engineers have together and separately realized the advantages of having machines equipped with unit drives. With one accord they have not only acclaimed the many advantages of unit drives, but have been instrumental in furthering their design and use.

In the field of machinery and machine drives in particular, much has been accomplished in a relatively short time. Due in part to the advent of electricity the whole field of thought in that direction has been revolutionized. Increased use of electricity has caused changes to be made at such a rapid rate that to follow them all is next to impossible. To illustrate the complete change in the attitude of engineers toward the utilization of power in terms of its point of generation, the following incident is apropos. Some years ago there appeared before the British equivalent of the American Society of Mechanical Engineers a prominent engineer who "proved beyond a shadow of a doubt that it would be more economical to transmit power by belting and line shafting for a distance of 50 miles rather than to trans-

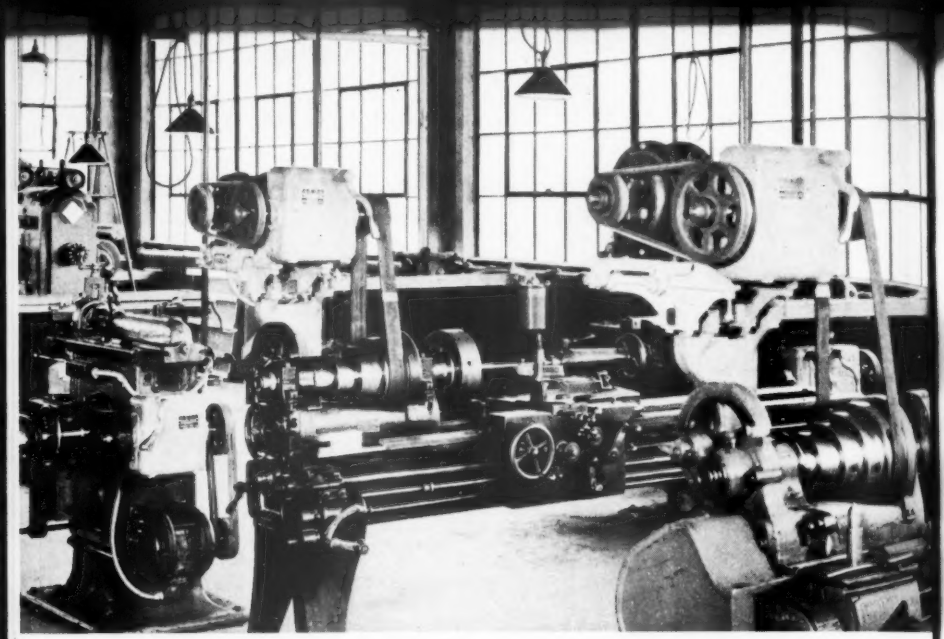


Fig. 1—An orderly arrangement is possible with unit driven machines.

mit the power in terms of electrical energy for the same distance by wire conductors."

The obvious fallacy of his premise as well as his conclusion has been so completely proven that today we are even eliminating the use of line shafting and overhead belting in transmitting power from one point to another in the same department. And what is more important, we are doing it with increased efficiency, with greater machine flexibility, with less danger to life and property, with less noise and confusion and consequently with much improved working conditions.

Much can be said regarding the advantages of unit drives, but another article to follow in the near future will cover this phase of the subject more adequately than a few words here could hope to do.

In the field of new machinery, the tendency toward unit drives has been particularly evident. These newer type machines, according to users, have proven vastly superior in every respect to the line shaft type of drive. Unit driven machines have been the plant layout men's dream of Utopia because they are no longer tied to a specific arrangement or system of alignment. The machines are completely at the discretion of the layout man as regards their location. They can now be placed "functionally" and consequently to the best advantage and for the greatest efficiency of flow.

In the past it was necessary to get speed variation by changing the belts from one step on the cone to the other. When nothing better was available, this appeared to be the simplest and best arrangement. It was necessary, whenever changing speeds, to get a belt hook and work the belt over into a new position. Occasionally the belt would slip off; often the hook would get caught in such a way as to injure the operator; sometimes the long flapping belt would break, hurting someone nearby and practically shutting down the entire plant; and in all cases there was unnecessary loss of operator time and machine time.

These uneconomical factors can all be things of the past because individual drives with their integral transmission give required change in speed with the flip of the wrist, a twist of the hand, and with complete safety.

(Continued on Page 168)

By Don F. Hoffman
Detroit Mold
Engineering Company

Indirect Ejector System For Injection Molding

The current series on the design of the modern injection mold has previously described the sprue, sprue puller, cold slug well, runners, gates, venting and direct ejector systems. This article takes up indirect ejector systems.

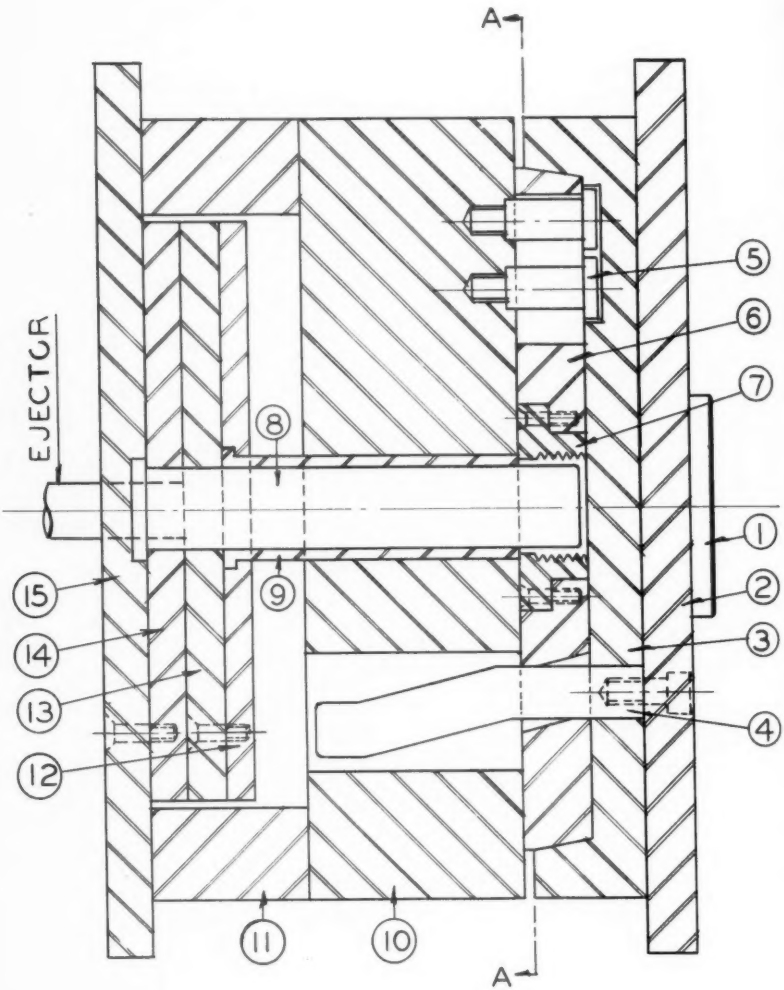
INDIRECT systems of ejection include loose bar, split cavity plate operated by offset cams and incorporating sleeve ejectors, rack operated core pulling mechanisms, sliding cavity plates operated by finger cams, and miscellaneous types.

Loose Bar

Often moldings are of such intricate shape that they must remain on their respective cores because of the impracticability of removing them in the direction of the travel of the press platens by direct ejection systems. The easiest and simplest mold design is to mount the cores in a removable plate which is removed from the machine and from which the molding is stripped at a bench. A simple application, for example, is a pencil box with a core 6″ deep by ½″ by 1¼″ and with wall thickness of .055″. Since all injection machines have a limited opening, and because of the excessive amount of steel required in the direct ejecting mold, that is, a pin or a sleeve ejection type mold, it would be impracticable to use anything except a loose bar type mold. The construction of the mold would be such as to have the cavity and core in a vertical position, with a locking device on the core to hold it in position against the injection pressure. Each half of the mold would contain one half of the cavity opening.

Offset Cams and Sleeve Ejectors

If a more mechanical type of mold is desired rather than a loose bar mold, the ejection of the piece or withdrawal of the cores by means of an offset cam action mold may be easily accomplished. A mold construction of this type is illustrated in Fig. 13. Guide pins, assembly screws, water lines, sprue bushing, and other parts have been eliminated to give a better conception of the ejection system. The cavity halves, which form the outside contour of the molding (detail 7), are located on the center line of the mold in a vertical position and each is

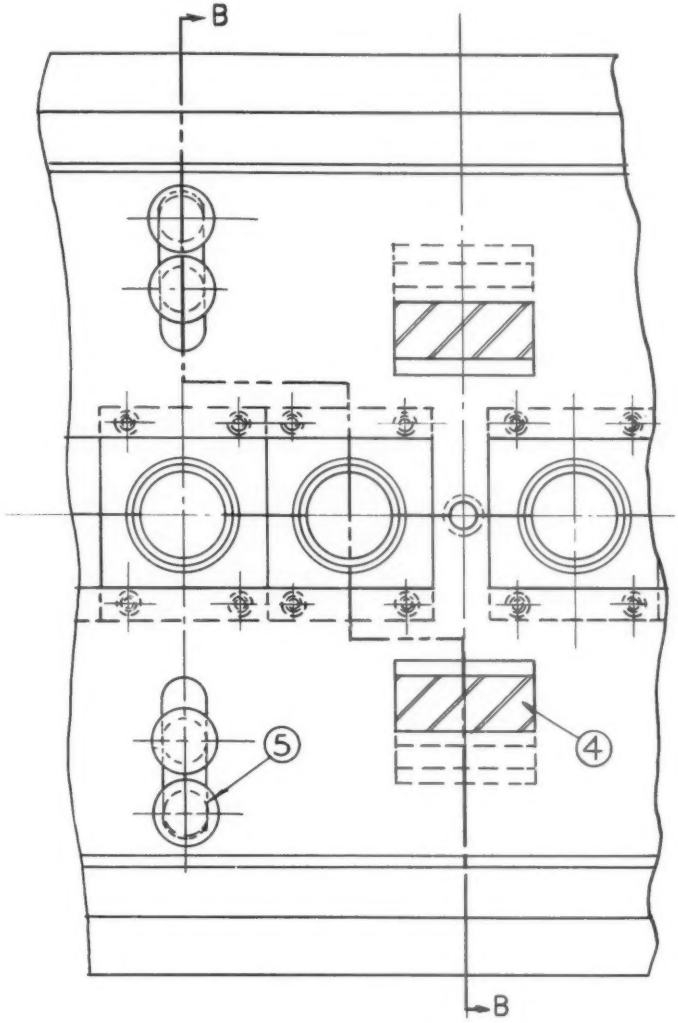


SECTION B B

Fig. 13

PRINCIPAL PARTS

1. Centering Plate
2. Stationary Clamp Plate
3. Stationary Cavity Plate
4. Offset Cams
5. Shoulder Screws
6. Sliding Cavity Plates
7. Cavities (halve)
8. Core



PLAN VIEW AA

Fig. 13

9. Ejector Sleeve.
10. Sliding Cavity Back-up Plate
11. Parallels
12. Sleeve Ejector Retaining Plate
13. Sleeve Ejector Assembly Plate
14. Core Assembly Plate
15. Movable Clamp Plate

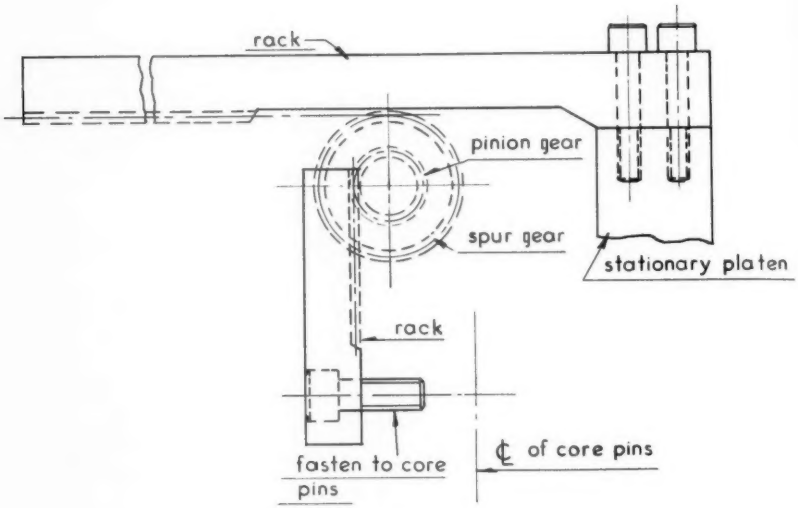


Fig. 14

fastened to split plates (detail 6). The core (detail 8) forms the inside contour of the molding. It is held in a stationary position in the rear clamping plate (detail 15) by the assembly plate (detail 14). Around the core an ejector sleeve (detail 9) fits loosely in the retainer plate (detail 12) and its bearing surface on the core is relieved to decrease friction and possible binding and seizing. As previously described in the direct ejection systems the bearing of the sleeve on the core is entirely at the front end which allows a considerable amount of freedom to take up misalignment at the back end. The offset cams are pressed fitted in the stationary cavity plate (detail 3) and remain fixed through the aid of two socket head cap screws. The split plates (detail 6) ride on these offset cams. The stationary cavity plate (detail 3) has angular faces which lock the sliding cavity plates in position for molding. Shoulder screws (detail 5) are placed symmetrically on the movable half of the mold and their purpose is to prevent misalignment of the split plates.

The mold operates automatically. As the mold opens about ¼" the angular face of the offset cams start to move the sliding cavity plates outward clearing the molding. As the mold continues to the fully open position the positive ejector of the machine comes in contact with the ejection plate and moves the sleeve forward which strips the molding from the core. This permits the molding to drop free of the mold. As the mold closes to resume the molding cycle, the offset cams close the cavity halves. The ejector plates may be returned by springs or positive return pins as previously described under direct ejector system.

It is not necessary to employ pins and sleeves as ejectors in this type of mold. At times it may be feasible to arrange the offset cams with a longer, straight portion before starting the angular face. This will permit the molding to be stripped free of the core before the split plates move outward. After the plates move outward they allow the molding to drop free. It is well to mention here that the sprue lock or the cold slug may be ejected by a direct system or may be designed in a manner to be easily removed with the molded castings.

Rack and Core Mechanism

The stationary side of this mold, shown in Fig. 14, contains half of the

PRINCIPAL PARTS

1. **Stationary Clamp Plate**
2. **Stationary Cavity Plate**
3. **Finger Cam**
4. **Sliding Cavity Plate**
5. **Back-up Plate**

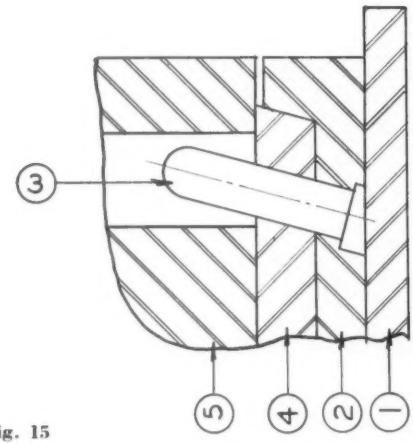


Fig. 15

cavity for forming the outside contour of the molded piece. Also located on the top of this side is a bar to hold the core in position during the injection cycle.

The movable side contains the other half of the cavity and the direct type of ejectors for removing the sprue and molded parts.

The cores, which form the inside contour of the molding, are in a vertical position and have bars long enough to fasten to a central rack. As illustrated in Fig. 14, the teeth of this vertical rack are engaged with those of the pinion gear. The pinion gear is keyed to the same shaft as the spur gear. Methods of mounting the shaft, pinion, and spur gear vary. They are shown mounted on a bracket fixed to the movable half of the mold. The horizontal rack which engages the teeth of the spur gear is mounted to the stationary platen in a level position.

The mold should be designed for fully automatic operation. As the mold opens, the cold slug will pull the sprue, and the core pins will retain the molding on the movable side. When the mold has opened to a limited position, the rack fastened to the stationary platen engages the spur gear, which in turn causes the pinion gears to mesh with the core rack. This pulls the core rack, which is fastened to the core pins, in a vertical direction to clear the molded piece. As the mold continues to the fully open position the ejectors of the machine come in contact with the mold ejector mechanism which causes the sprue and molded pieces to be stripped. Upon closing of the mold the ejector pins return to molding position, and the gear train returns the side core.

Finger Cams

A sliding cavity plate operated by finger cams, as illustrated in Fig. 15, is similar to an offset cam mold except here the cavity plates tend to open immediately as the mold opens. Cavities and cores are retained in the same manner. As shown in Fig. 15, the finger cam (detail 3) is pressed fitted in the stationary cavity plate (detail 4). The cavity plate has angular faces at the same angle as that of the cam.

Miscellaneous Types

Air cylinders may actuate various types of ejection under control of solenoids which may be connected to the timing devices of the molding machine so that the whole operation becomes fully automatic. Although this equipment is expensive, it has a high salvage value and its cost may be spread over several molds.

Automatic unscrewing devices are numerous. These are generally limited

(Continued on Page 169)

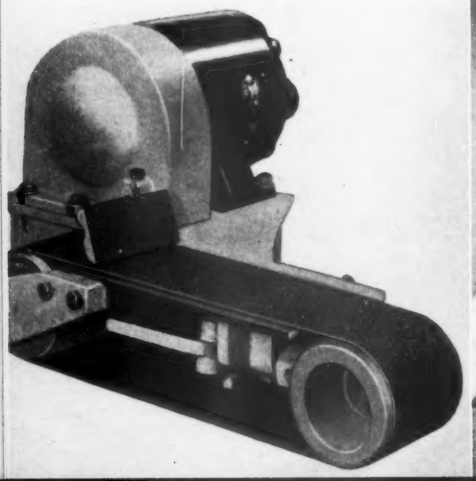
PROGRESS ON P

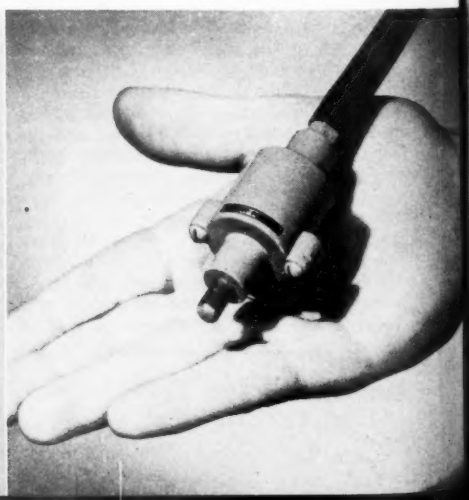
THIS new bench type abrasive band grinder (bottom, left) recently introduced by Walls Sales Corp., 97 Warren St., N. Y. C., incorporates many improvements. Heavily constructed and built to machine-tool specifications, Standard D-4 is powered by a ½ hp motor (protective hood) with a fully enclosed V-belt drive. This improved machine is equipped with an Alemite lubricating system.

MEAD Specialties Co., 15 S. Market St., Dept. M-29, Chicago, Ill., has just announced the Midget Air Clamp (right) for assembly jigs and other multiple applications. This new low-cost pressure unit, designed expressly for the aircraft industry, promises to save countless man-hours in all operations involving the joining by welding, riveting, or bolting of two or more component parts of any assembly. This clamp delivers 80 lbs. pressure on a line pressure of 100 lbs. The stroke of the ram is ⅝". An internal return spring withdraws the ram when air is exhausted from the cylinder by the control valve. The action is instantaneous.

THESE end brushes (left on opposite page) that revolve on ends of power shafts and find their way into crevices, grooves, holes and indentations to clean, chip and polish are breaking many war production bottlenecks. From top to bottom in the illustration the brushes are: weld cleaning brush, cable end brush, end bonding brush (left) for cleaning zinc chromate from around rivet holes in airplane structures, and a series of three end brushes for a variety of jobs. Manufactured by Osborn Mfg. Co., Dept. T-J, Cleveland, O.

INSPECTION and work identification stamps for the aviation, automotive

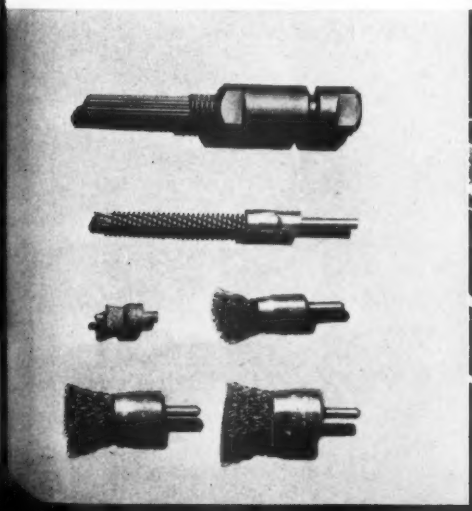


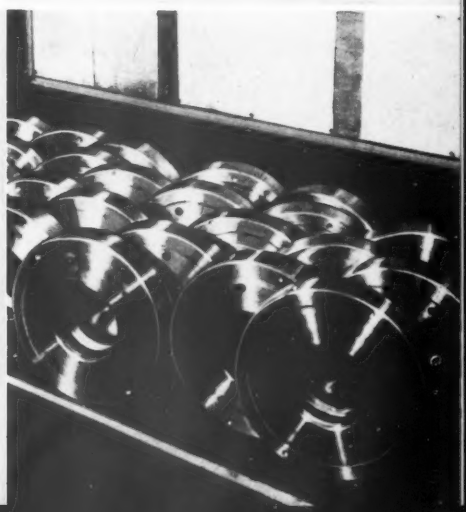


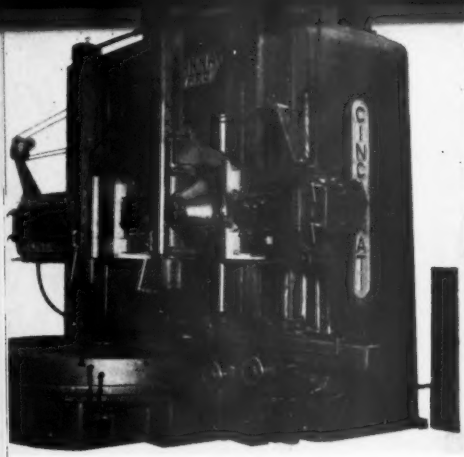
PARADE

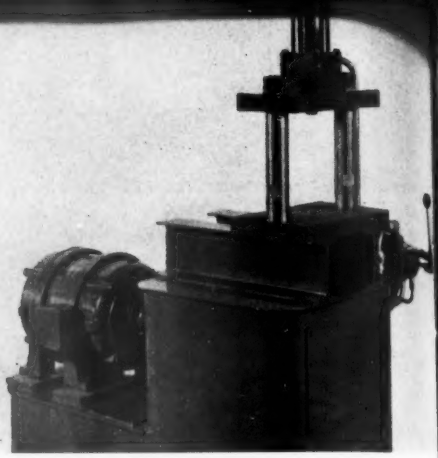
and allied industries are now made by J. H. Matthews & Co., 3948 Forbes St., Pittsburgh, Pa., from a new synthetic material. This synthetic, unlike rubber, will not disintegrate when used with acid. The peg and pin stamp (right, top) is used where large volume inspection and product control stamping is required. Shape and contruction of stamp makes it easy to handle—easy to store.

ARMY ORDNANCE reports that 12,600 tons of critical brass is being saved on one contract in the conversion of 105 mm shell from brass to steel. This development has been facilitated by the adoption of drawing dies with extremely hard cemented tungsten carbide centers. Produced by Carboloy Co., Inc., six sets of four dies each (lower right) will produce an estimated 1,000,000 steel shell cases.

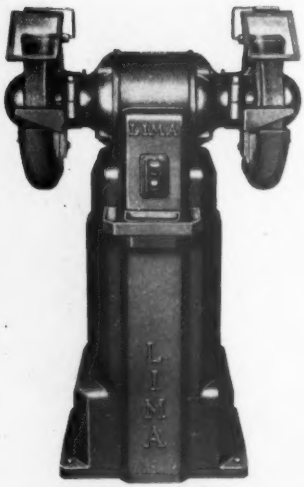




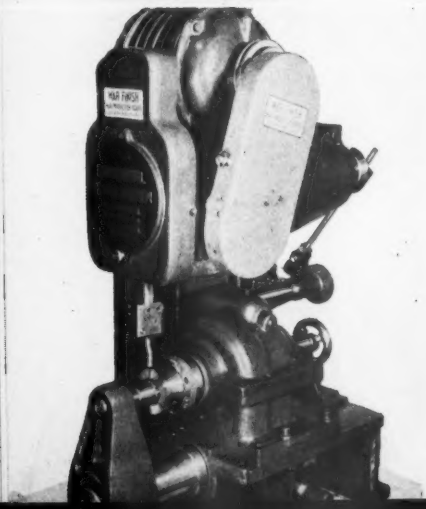




THE 8′ (heavy) Cincinnati Hypro Vertical Boring Mill shown at the top left is equipped with two ram type swiveling rail heads and one right hand side head. The main drive, table and spindle are automatically lubricated with oil pumped from a reservoir in the base through a filter and then distributed to the working parts. Manufactured by the Cincinnati Planer Co., Dept. J-2, Oakley, Cincinnati, O.



A NEW Hydraulic Arbor Press, rated at six tons, with an 8″ maximum stroke, 20″ of daylight and an opening of 20″ from left to right, is announced by Hydraulic Machinery, Inc., Dept. T-2, Detroit, Mich. The arbor press and power unit combined occupy only a 27″ x 42″ floor space. It is equipped with a manually operated four-way valve that is self centering—the gage registering from 0 to 2000 lbs. pressure.



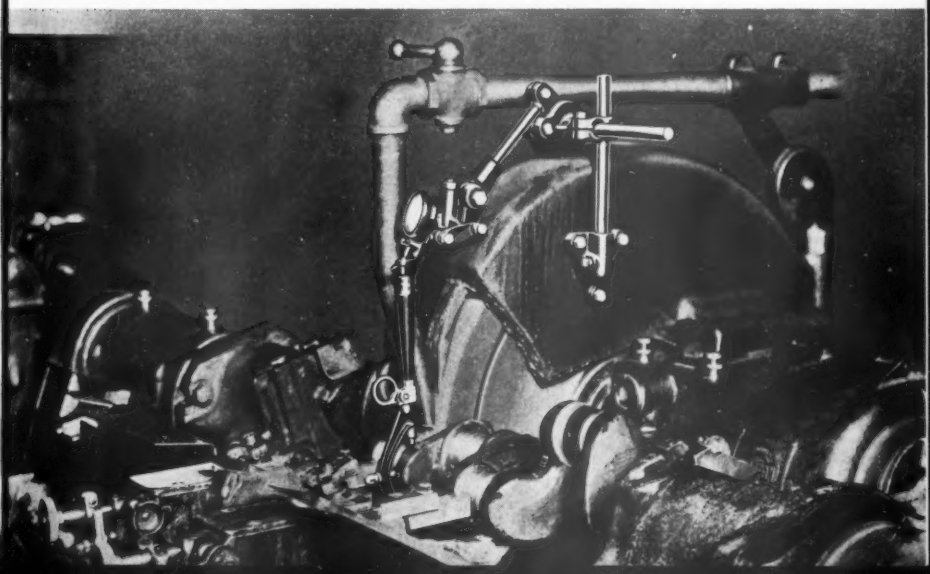
THE Lima tool room pedestal grinder is the latest development of the Lima Electric Motor Co., Lima, O. Designed for accurate and economical tool room grinding, this model has features which make it popular with shop men.

The totally enclosed, dust tight, heavy duty ball bearing motor is furnished in 2 or 3 hp, 1800 rpm, 2 or 3 phase, AC, 220, 440, or 550 volts. A push button motor control affords protection against an overload. Standard equipment includes the motor control, a combination lift-out water pot and tool tray, and wheel guards.

A STANDARD "Slotmaster", bottom of opposite page, and an ingeniously constructed indexing mechanism for slotting the teeth on clutch jaws was recently built by the Hoover Tool & Die Co. and the Experimental Tool & Die Co., 12609 Greiner, Detroit. This machine makes a complete cycle automatically and the finished part is an exact duplicate of the master cam.

THE Lyon-Raymond Corp., 1077 Madison St., Greene, N. Y., claim that the average dollar today invested in material handling equipment releases one to three dollars worth of labor for other war jobs each year. The die handling and stacking truck illustrated can be used with just the platform for lifting and stacking or just the boom as a crane to pick up dies or as a combination of both to separate dies.

THE special purpose gage shown at the bottom of this page is made to measure a grinding operation while in process. A polished diamond contact point which will not scratch or wear measures the reduction of the diameter of the part being ground. A visible check on out-of-roundness, rough grinding and chatter is instantly shown. With special gages, manufactured by American Diamond Tool & Gauge Co., 15924 Woodingham, Detroit, Mich., an operator can grind until the work meets the desired specifications.



Industrial Digest

TOOLING • PRODUCTION • WAR NEWS • PUBLICATION REVIEW

"Hard Chrome" Helps Solve Tool Shortage

At this moment we are faced with a shortage of perishable tools—drills, reamers, taps, gages and similar items. Manufacturing facilities for small tools are being taxed to the limit. Still the shortage grows. Obviously something will have to be done about it. Fortunately, the life of cutting tools can be extended tremendously by a method employing hard chrome plating. The procedure is at least ten years old, and has been improved considerably in the last few years.

In order to make use of hard chrome in prolonging tool life, it is necessary to adjust our whole method of using tools. Instead of using a reamer or a drill until it is hopelessly worn, tools should be first given a light application of hard chrome plate before being put into service, and then subsequently removed from service for retreatment before the chrome coating is worn through to the steel.

After removal from service, the tool is stripped of the remaining chrome and replated to the exact original size. Except in unusual cases, it is not necessary to finish-grind after replating.

Such a system involves the development of an entirely new routine of tool use. The hard chrome tool saving method was advanced in 1932, at the depth of the Depression. Manufacturing organizations at that time were more concerned with getting something to machine rather than with the question of how to machine it.

With little output, men were spreading their activities almost to the tearing point. Is it so remarkable that a new method, involving changes in the tool using habits of a lifetime, did not readily become popular?

Then, too, in most systems of cost accounting, small tools are written off completely just as soon as they emerge from inventoried stores. A saving made possible in the life of small tools, therefore, was not evident to the average executive.

The best way to explain why the process was not extensively used is to say that it was way ahead of its time. As was said at the time Billy Mitchell was vainly tearing out his heart in the interests of military aviation, "The only thing worse than being completely wrong is to be right too soon."

But now the time has arrived when hard chrome plating, as a means of breaking the tool bottleneck, begins to justify all the hopes and aspirations of its discoverers ten years ago.

"Seasoned Troops" on the Industrial Front

On the production front millions of raw recruits in war industries have been trained in the exacting discipline of new war jobs. As in the military services, intensive training for particular operations is as vital as experience on the job. It is essential, too, to have an

adequate force of industrial "officers" to train our vast army of war workers. These have been provided in the more than 320,000 supervisors, foremen and crew chiefs who have been certified as job instructors in some 6,500 war plants. In about 1,900 of these plants labor-management committees are engaged in furthering the training and upgrading of workers.

In addition to this program of training within industry, pre-employment training outside of war plants is now given free to 160,000 persons throughout the country. According to figures compiled by the Office of War Information it will be necessary for 320,000 to 500,000 more prospective war workers to take outside preliminary training. These newcomers to war work will be part of the additional labor force, estimated at 2,500,000, needed by the end of 1943. These figures do not take into consideration the several million war workers who will be gradually withdrawn from industry under the "manning tables" plan to enter the armed services.

Machine Tool Priorities Have Changed

Preference ratings no longer affect delivery schedules for the 75% of machine tool production allotted to service purchasers. Delivery schedules are now determined by the urgency standing of the Army, Navy, Maritime Commission, or their contractors or subcontractors. Urgency standing is established by the confidential numerical master preference list.

Orders from service purchasers without urgency standings are to be scheduled according to the date of receipt of the purchaser's preference rating certificate.

Delivery schedules for the 25% of machine tool production allotted to foreign and other nonservice purchasers continue to be governed by preference ratings.

Dormant Scrap Drive Continues For Duration

From the War Production Board comes recognition of the ability of steel warehouse salesmen to identify and stimulate the movement of dormant scrap from industrial establishments.

Continuing where the American Steel Warehouse Association's Drive left off on December 31—a new duration scrap program has been inaugurated to extend the work begun during the last three months of 1942. The new program has been expanded to include all members of the Steel Warehouse Industry and has the unqualified support of Donald M. Nelson, Chairman of WPB, and Hamilton W. Wright, Chief of the Industrial Salvage Branch of WPB.

This duration program assures WPB of the continued help of 1500 to 2000 well qualified steel warehouse salesmen.

These men—acting as certified volunteer fieldmen—work under their own sales managers and the local WPB Regional Salvage Managers. They augment the local WPB field staff in each territory.

Commenting on the program in a recent letter, Donald M. Nelson says—"This action assures an all-out total warehouse industry campaign and should result in moving into the flow, at once, hundreds of thousands of additional tons of dormant scrap iron and steel which otherwise would not move for some time or not at all."

INDUSTRIAL DIGEST

Munitions Production Hits New Peak

The biggest monthly gain in munitions production since we began to rearm in the summer of 1940 was scored in November, WPB Chairman Nelson reported last week. The percentage increase in volume of planes, tanks, guns, ammunition, ships and other munitions in November was 12%, compared with a rise of 4% in October. This breaks a six-month series of declining percentages of gain that began in May, 1942.

Worker Suggestions Aid Production

The war production drive suggestion awards system has done much toward achieving greater production with fewer workers and less material. Of the suggestions received in the past month 128 were judged by plant committees to be so important that they were sent to Washington for governmental recognition. For 30 of these suggestions alone, the committee estimated that 112,459 man-hours are saved annually.

An outstanding example of a suggestion conserving manpower, recently submitted to war production drive headquarters, combined two operations in the manufacture of milling cutters, saving 4,197 man-hours in one year on present operations.

All outstanding suggestions are "plowed back" into industry in order that all American war plants may adopt them. An international exchange of ideas is now underway, sending the best suggestions received at war production drive headquarters to England. Plans are also being made to distribute these suggestions for adoption by all war plants of the United Nations.

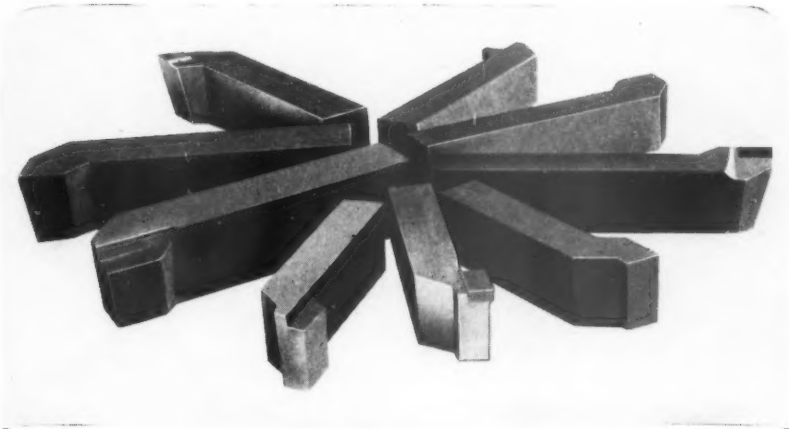
Scrap Picker Does Work of Six Men

A self-powered magnetic scrap picker, designed and constructed by The Timken Roller Bearing Co. from odds and ends, was placed in operation recently and is doing the work of six men gathering up scrap in the company's railroad yards. In two hours' time, it does the work that three two-man crews formerly did in 24 hours.

Mounted on an ingot buggy, it is powered by a Hercules, Ford V-8 diesel replacement engine that drives a 230-volt DC generator. The generator supplies power for the magnet and the electric motor drive.

The magnet is 39" in diameter and can lift 900 pounds of heavy scrap or 300 pounds of turnings per load.

(Continued on Page 163)



There is No Scarcity of Victory Tool Shanks

Cast of tough Meehanite Metal, they outperform and outlast hard-to-get carbon steel

For any shop equipped to tip its own cutting tools, Victory Tool Shanks offer these attractive advantages:

1. They have double the vibration damping capacity of steel.
2. Their heat dissipation is far superior to that of steel.
3. The coefficient of expansion of Meehanite is closer to carbide than is steel.
4. They require a minimum of machining before use.
5. They are available NOW.

Victory Tool Shanks are stocked in many standard sizes and shapes. Special shapes can be cast to your specifications.

WRITE FOR BULLETIN No. 52T-1 which shows sizes and prices. Pick out a size you can use and ask for free samples. Small quantities can be shipped within a few hours after receipt of order.

THE COOPER-BESSEMER CORPORATION
Sugar Street, Mount Vernon, Ohio

Cooper-Bessemer

To a Kid Named Bill

WHO SOME DAY WILL DESIGN THE PLANES OF PEACE!

BILL—you and thousands of other boys are doing a swell job building scale models of fighting planes. Keep it up! American airmen need those models to sharpen their shooting eyes.

But, Bill, in your earnest desire to help now, don't ever forget your dreams of the future and of the better plane you hope to design. Keep thinking, keep planning and, above all, keep learning. Your day is coming sooner than you expect.

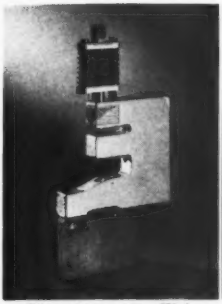
And so that you may have that opportunity in a world at peace, Bill, we at Sebastian Lathe are working 'round the clock. Already we have increased our production 800%. But we're still not satisfied. We don't want your plane to be a fighting plane.

SEBASTIAN PRECISION IS OUR BUSINESS

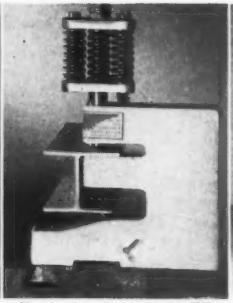
SEBASTIAN LATHES

Manufactured by STOKES INDUSTRIES, INC.

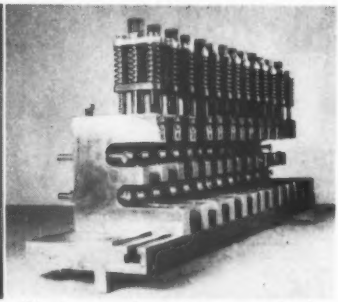
P. O. Box 1017E, Cincinnati, Ohio, U. S. A.



Showing one Wales Type "E" Hole Punching Unit on section of press brake rail.



Example of typical "H" section being punched by Wales Type "E" Unit.



This line-up of units is an example of a few units set on a short section of press brake rail. Wales Punching Units can punch over 200 holes at the same time on a rail.

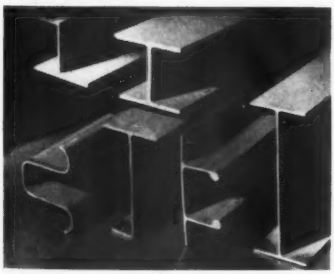
NEW! WALES TYPE "E" UNITS

FOR PUNCHING HOLES IN EXTRUDED AND SHAPED SECTIONS

From light trainers to HEAVY BOMBERS, Wales Type "E" Units "lick" one of Aviation's most difficult hole-punching problems — punching a series of holes simultaneously in extruded shapes on press brakes.

Center projection carrying die member extends into all kinds of shapes and provides clearance for other legs in the lower gap. The work rests on top of the die during punching operation.

A few of many shapes that have been punched by Wales Type "E" Units. CALL ON STRIPPIT ENGINEERS TO SOLVE YOUR HOLE PUNCHING PROBLEMS.



TIME SAVING . . . MONEY SAVING FEATURES OF WALES HOLE PUNCHING UNITS

Nothing is attached to press ram . . . punch and die holder unit is self-contained . . . punch and die are always in perfect alignment . . . each individual unit can be removed or reset on rails . . . punches, dies, guides, and strippers can be removed from holders quickly . . . interchangeable punches and dies punch various sizes and shapes with the same holders . . . die-setting time and press "down-time" are cut from hours to minutes . . . provides unlimited scattered and straight-line set-ups.

THERE'S ALWAYS SOMETHING NEW IN THE WALES LINE

Last month it was Wales "CD" Units, this month it is Wales "E" Units, and next month— announcement of a new Wales Hole Punching Unit, so keep posted by writing to —

THE STRIPPIT CORPORATION

345 Payne Avenue North Tonawanda, N. Y.

GEORGE F. WALES, President

Specialists in Punching and Notching Equipment

WHEN YOU CAN'T GET SPECIAL TOOLS
Super STANDARD TOOLS ARE EASILY ALTERED TO SUIT YOUR NEEDS
Ask for Circular No. 40
SUPER TOOL CO.
21650 Hoover Road
Detroit, Michigan
CARBIDE TIPPED TOOLS
FOR TURNING • FACING • REAMING • SPOTFACING • BROACHING
FORMING • GRINDER RESTS • WEAR PARTS • BORING • MILLING • DRILLING
GROOVING • COUNTERBORING • SHAVING • CENTERS • SPECIAL PURPOSES

American No. 2
PLAIN MILLING MACHINE

for
SPEED, ACCURACY AND VERSATILITY
in
ARMAMENT PRODUCTION

Infinite Spindle Speeds—25 to 500 r.p.m.

Standardized Spindle Nose. Spindle heat treated chrome-nickel steel with No. 40 taper.

Motor in Base Drive. 3 hp U. S. Vari-Drive motor. Twin-Disc Duplex Machine Tool Clutch.

Heavy Rugged Construction. Heavily proportioned column houses motor drive and power shafts.

PROMPT DELIVERY

SEE OUR CATALOG IN SWEET'S

Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

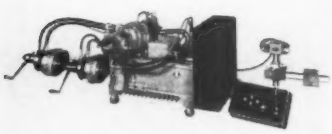
Table working surface	46"x10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

WRITE FOR FOLDER

J. L. LUCAS & SON, INC.
BRIDGEPORT CONNECTICUT

How to Get
MASS PRODUCTION
from TOOL ROOM TOOLS
High Speed Production at Tool Room Limits Without Specially Built Machinery

Many of the foremost producers of war goods are faced with the novel necessity of making tool room tools perform at mass production speeds at limits of accuracy previously never expected outside the tool room. They have, through the use of machine tool controls, been able to make ordinary tool room machine tools "do the impossible."

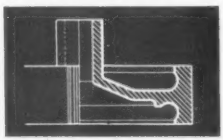


The DUAL DUPLIMATIC, entirely self-contained, puts almost any machine tool on a mass production of tool-room-limits basis.

Separate machine tool controls have placed many of the operations on a full automatic basis; the most skilled of their operators have been released for work of greater importance. The elimination of the necessity for increased floor space and excessive long waiting for specially built equipment has been entirely obviated. These machine tool controls, DUPLIMATICS, manufactured by the Detroit Universal Duplicator Company, are now being used throughout the country on war goods production exclusively. The type of work that can be handled is described as follows.

AUTOMATIC CONTOUR TURNING

This sketch shows a thin section propeller gear housing which was of too intricate contour to be machined by manual operation, too thin to be done with forming tools. Also, too few a number were required too fast to permit the designing and building of equipment for this one operation alone.



A "DUAL" DUPLIMATIC was connected with the cross and longitudinal feeds of a standard Reed-Prentice lathe. Both feed screws are turned automatically and simultaneously as required to feed the cutting tool in and out.

The work is chucked in the usual manner. A template of the exact size and outline of the finished work is fastened to the cross feed carriage. A tracer, clamped to the lathe bed, is adjusted so that its stylus can contact the template. The moment the operator starts the lathe and touches the starting button on the control panel of the DUPLIMATIC, the latter "takes over" entirely on a full automatic basis—moving

the cutting tool automatically along the exact path of the finished work.

Since the operation is entirely automatic and since the feed on both screws is simultaneous and graduated in extremely fine increments, blending of radii is certain and even the straight portions of the work are of such fine finish that very little hand-finishing is required. DUPLIMATICS have shown an increase of 7 times the production possible with manual control. Moreover, a decided decrease in hand-finishing and scrapped parts has resulted.

AUTOMATIC CONTOUR MILLING

Milling the contour of aircraft connecting rod cavities is now being done on standard vertical milling machines. In this instance, there was no waiting for special equipment, nor any special training required for the operators of the machines. This operation, while requiring the close-finish of tool room die sinking work, has to be done at speeds impossible with manual operation alone.

The "DUAL" DUPLIMATIC, identical with that used for the contour turning mentioned above, turns the longitudinal and cross feed of the milling machine table. (If the depth of cut also had a contour or variation, a "THREE-WAY" DUPLIMATIC instead of the "DUAL" DUPLIMATIC would have been required.) A template is mounted on the table alongside so that it can be contacted by the stylus of the tracer.

This operation is also automatic, excepting that the operator is required to touch one of four "change-of-direction" buttons on a handy control panel when the milling operation is negotiating a corner of the work. Exceptional blending of radii has resulted in reduction of hand-finishing as compared with that required before the "DUAL" DUPLIMATICS were installed.

The DUPLIMATIC equipment used in this work is an entirely separate control mechanism which can be used with almost any machine tool. The advantages of the use of DUPLIMATICS are that no specially built equipment is needed; tool room tools can continue to hold the accuracies for which they were originally designed.

Specially trained operators are not needed. Usually the same operator, with a few hours' instruction, carries on. In some instances, relatively unskilled operators have replaced the old operators—the latter being released to do work requiring their particular skills.

The installation of DUPLIMATIC on a machine tool does not limit that machine to automatic duplicating only. The DUPLIMATIC can be quickly "de-clutched" from the feeds to permit manual operation.

DUPLIMATIC machine tool controls are used in some of the largest mass production shops in America, producing: TORPEDOES—BOMBS—MACHINE GUNS—AIRPLANE ENGINE PARTS—TANK TURRETS—ANTI-AIRCRAFT GUNS—AIRPLANE LANDING WHEELS.

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THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD
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BRAKE
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PUMP SPEED 700 S.S.F.
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WHEN TESTING SPEED LIMITING
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MUST NOT EXCEED 70 S.S.F.

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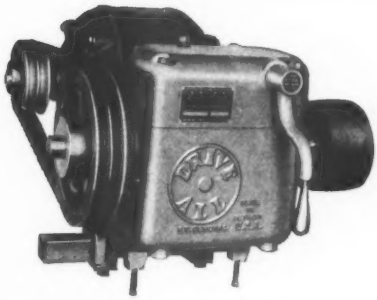

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Two Handy Nortons for the Tool Room

No. 2 Cutter & Tool Grinder with dual controls so it can be operated from the front or either side. Available with minimum equipment or a wide and complete assortment of useful attachments.

Type C. Multipurpose (Universal) Grinder with power table traverse. For external or internal cylindrical, face and angular grinding operations. Supplied in 12", 14" or 16" swing and lengths of 36", 48" or 72" between centers.

Catalogs on either or both machines on request—no obligation.

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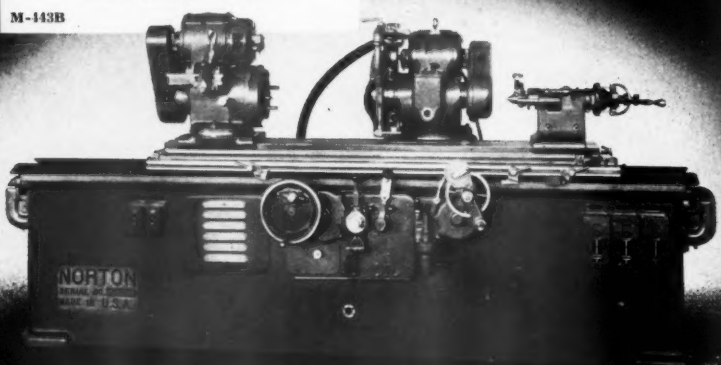

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SPEED PRODUCTION and they'll get the *Ammunition*

Threading and Forming Tool Holder. Right hand offset — for fine or coarse threading — no tool marks — more pieces per grind.

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Awarded to Auto-Ordnance Corporation for excellence in production of "Tommy Guns".

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THOMPSON TOOL DIVISION

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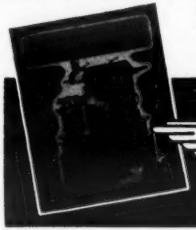
Choose your shaper to fit your work

THE NEW VERNON PRECISION BACK-GEARED 12" SHAPER has all the important advantages of large machines plus fast production and big savings in first cost, power and floor space. Within its capacity it will do anything as accurately as a larger machine—and do it faster and more economically.

It has the full range of essentials—power, strength, rigidity, speed, smoothness, accuracy, convenience in operation, adjustability, and long life. Its back-gearing provides ample power to drive through deep cuts without chatter or stall. Its helical-type bull gear is mounted in large Timken Tapered Roller Bearings and is adjustable for wear. Its speed is infinitely variable within the range of 15 to 170 strokes per minute.

These and other features make the new Vernon the best shaper on the market to relieve larger machines and get work out faster. Orders placed now get prompt delivery! Send for new bulletin with complete specifications.



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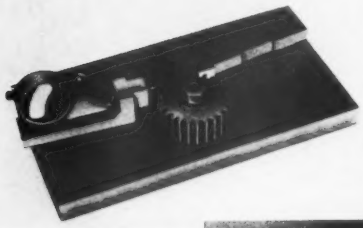

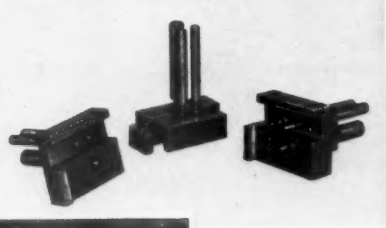

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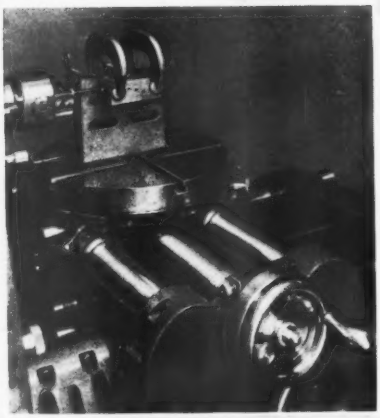

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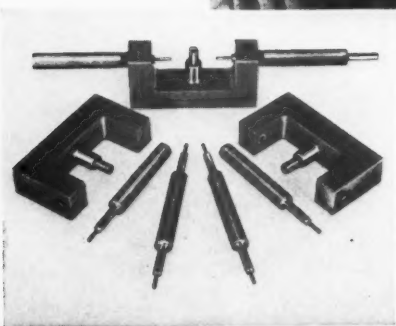

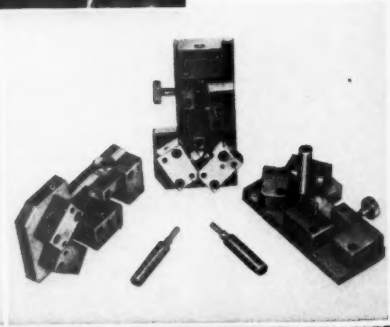

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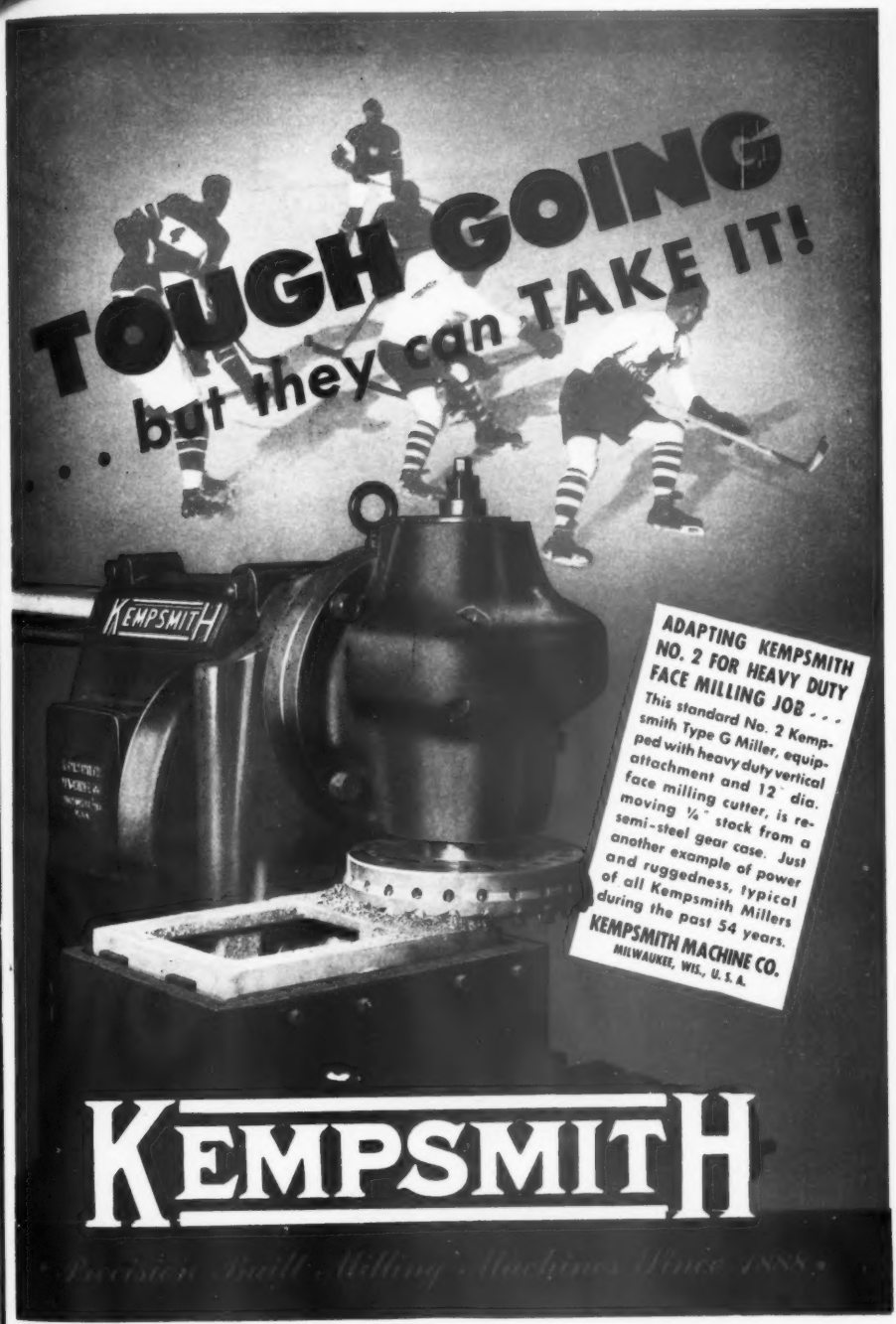
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. . . but they can TAKE IT!
KEMPSMITH
ADAPTING KEMPSMITH NO. 2 FOR HEAVY DUTY FACE MILLING JOB . . .
This standard No. 2 Kempsmith Type G Miller, equipped with heavy duty vertical attachment and 12" dia. face milling cutter, is removing 1/4" stock from a semi-steel gear case. Just another example of power and ruggedness, typical of all Kempsmith Millers during the past 54 years.
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TARGET FOR TONIGHT

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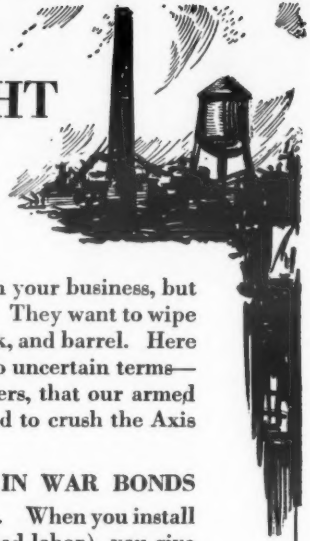

Maybe they won't actually come and drop a *bomb* on your business, but the Axis war lords have their eye on it, just the same. They want to wipe it out as a competitive force—or take it over lock, stock, and barrel. Here is a threat that you can reply to *now*, today, and in no uncertain terms—by buying War Bonds to the very limit of your powers, that our armed forces may have the guns, tanks, and planes they need to crush the Axis *once and for all.*

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Every American wants the chance to help win this war. When you install the Pay-Roll War Savings Plan (approved by organized labor), you give your employees that chance. For details of the plan, which provides for the systematic purchase of War Bonds by voluntary pay-roll allotments, write: Treasury Department, Section S, 709 12th St. NW., Washington, D. C.

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BETTER

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NOW, when the need is great, you can better your production of war material with American MonoRail equipment in many processes where handling impedes your war effort.

Later, after Victory, you will have essential equipment available for changes in product or process. American MonoRail, because of its extreme flexibility, offers such versatile application without costly adjustment or lengthy engineering. American MonoRail standard parts fit quickly into complete systems to solve a wide variety of handling problems. Prepare now for changes then—equip now for speed up toward Victory!! Let our engineers show you results obtained in hundreds of successful installations.

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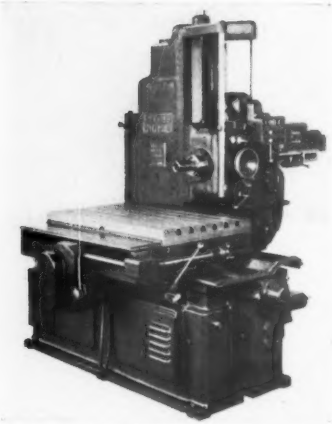

Jigmil For Boring and Milling Operations

THE Jigmil, now serving the combined function usually performed on horizontal boring mills and jig borers, features a new arrangement of basic structure and slide elements that comprise a heavy bed with a fixed bolted and doweled relation to the column. The bed slide is at 90° to the center of the spindle and is of sufficient length to adequately support the saddle for its full length of travel. Thus, the two basic slides, on which all accuracy depends, have a fixed relation.

Work retraction from the cutter position to facilitate measuring and tool setting is performed automatically. A push button unlocks the table and moves it by rapid traverse to the desired position for measuring. The table is returned to its cutting position, stopping and locking automatically ready for the cutting operation, by a single push button.

The accurate position of the horizontal and vertical slides for boring is obtained by measuring rods and indicators. Both slides are provided with scales and troughs for nesting the rods.

The master switch is carried on the spindle head, providing fingertip control and making it possible for the operator to fix his vision on the cutter.

DeVlieg Machine Co., 450 Fair Ave., Ferndale, Mich., will send literature at your request.

The enlarged Buy-With-Confidence section, pages 204-218, will prove helpful in solving the "who-makes-it" problem.

What is a MICRO-CHEK?

● The Trico Micro-Chek is a new type of comparator gage, used on inspection lines, or at machines, which speeds up the gaging of precision parts. It visually multiplies dimensions by 200. Its big, highly visible indicator greatly reduces eyestrain and fatigue. Its simplicity enables inexperienced workers quickly to become accurate inspectors. Our booklet tells more about its many applications.

WHO USES IT?

More than 1500 war plants and government arsenals—many of which time and again have reordered additional scores of Micro-Cheks.

INSTRUMENT SIZE 6" x 2½"

MICRO-CHEK with base plate only....$9.75
Adjustable Anvil.....$3.00
Other type Anvils available.

Send for FREE Micro-Chek booklet. Address:

TRICO

TRICO PRODUCTS CORP.
Dept. D, Buffalo, N. Y.

Information supplied by an Industrial Publication

A recent investigation of die spring breakage developed the following prominent causes:

1. Hydrogen embrittlement resulting from plating, pickling or cleaning.
2. Incorrect die design.
3. Incorrect spring size.
4. Speed of compression cycle.
5. Poor quality of wire.

There are, fortunately, remedies for all these conditions. Hydrogen embrittlement can be corrected by heating plated springs to about 450°F. and air cooling.

Faults in die design usually consist of either insufficient or too great clearance between the outside diameter of the spring and the guide hole. The clearance should be such that the spring operates freely, but has no chance to buckle.

Care should be taken in selecting springs to see that they are properly designed for both length of compression stroke and speed of compression. If springs are repeatedly compressed too close to their solid height, quick failure will result. The same is true where the rapidity of compression is too great.

It seems obvious that the quality of the spring wire should be commensurate with the job. Cheap wire should be avoided because of defects that are bound to cause trouble, especially when springs are plated.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE BRIQUETTES • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

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500 Fifth Avenue New York City

MOLY

Spacing Device for Many Machining Operations

WITH its attachments and fixtures, the Super-Spacer is adaptable for milling, drilling, grinding, jig boring and slotting, at speeds and feeds limited only by the capacity of the holding means and the power of the machine. It is simple, compact and rugged in design, substantially and precisely constructed of dependable materials.

Heavy cuts do not impair the accuracy of indexing as the powerful clamp relieves the index plate and plunger of all strain by binding the turret solidly to the base. Indexing is extremely rapid and positive and the mask plates remove all possibility of error. The reversible jaw self-centering chuck provides a secure and sufficiently accurate means for holding most jobs. However, when more precise centering is necessary, special holding fixtures may be mounted on the face of the chuck and located from the concentrically ground hole.

The Super-Spacer assures a high degree of accuracy.

Hartford Special Machinery Co., 281 Homestead Ave., Hartford, Conn., has available Bulletin No. S-101.

The HEAD that puts Production AHEAD

When production must roll at full speed, you'll find the knurled heads a big help. Fingers grip them without slipping, when using

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SIZES No. 4 to 1½" DIAM.

SOCKET HEAD CAP SCREWS

. . . so screws can be turned faster and farther before a wrench is needed. Knurling also permits making adjustments with pliers where a wrench may be inconvenient. It also makes possible locking the screws after countersinking. We'll gladly tell you how.

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Like setting the last rivet as the plane comes off the production line—burring, finishing and polishing to minute specifications mean the job is right.

Expert design, best quality materials, skilled workmanship—these are not enough without that all-important finish.

There is a "just right" Chicago Mounted Wheel for every polishing, grinding and burring operation, backed by the long-life guarantee that has made Chicago Mounted Wheels famous since their introduction 45 years ago.

PROMPT DELIVERIES—Count on us to help you break bottlenecks due to slow grinding wheel deliveries. We're working 24 hours a day, every day, and due to our central location, can make prompt shipment on all Mounted Points and Grinding Wheels 3" in diameter and under. With the approval and endorsement of the WPB, all our facilities are concentrated on these smaller sizes, enabling us to give the most potent service to the war program.

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America's Headquarters for Mounted Wheels

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Send Catalog Coupon for your copy showing in actual colors and sizes the largest line of Mounted Wheels made.

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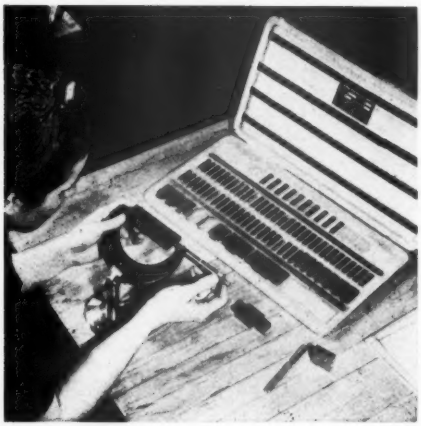


Grinder Manufacturer Builds Gage Blocks

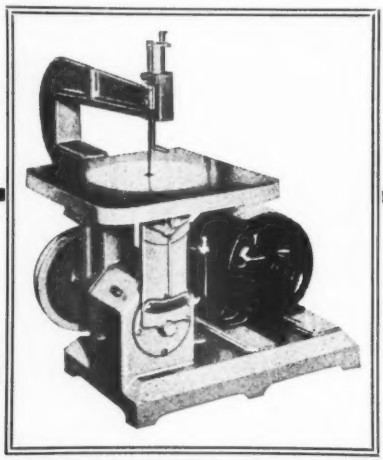
A STANDARD set of DoAll Master Gage Blocks, designated as Set 400 and consisting of 81 blocks, is being produced in quantity at present by Savage Tool Co., builders of the well-known DoAll precision surface grinder.

The 81 individual blocks range in length from .050" to 4". Each, in addition to being extremely accurate in length, has its measuring surface lapped to a flatness of less than the quarter wave length of light and is produced with a mirror finish. These two factors permit the blocks to be wrung together in combination, enabling the user to secure practically any dimension in steps of .0001" from .1000" to 12".

Precision optical measuring instruments are used to check the accuracy of every gage block produced. This equipment is also available to users for rechecking their gage blocks after they have been in use. The DoAll gage blocks are produced in AA grade (accuracy .000002"), A grade (accuracy .000004"), and B grade (accuracy .000008").

The illustration shows DoAll gage blocks in the sturdy mahogany case supplied with the gages. The inspector is checking a 4" micrometer.

Savage Tool Co., Dept. TD, Savage, Minn., will send full particulars.



Price, complete with motor— **$125** Net

F.O.B. Chicago

IMMEDIATE DELIVERY—Atlas Die Filing Machines

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The holddown fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

ATLAS EQUIPMENT CO.

101 S. Clinton St. Chicago, Ill.

Detroit Distributor—International Machinery Co.
3131 E. Jefferson Ave. Detroit, Mich.

VERSATILITY *at your FINGERTIPS!*

—FOR COUNTLESS JOBS IN YOUR PLANT

Every Foredom Flexible Shaft Machine has this *exclusive Foredom feature:* quick interchangeability of four types of handpieces—making Foredom the most versatile, most adaptable general utility machine available today. For grinding, polishing, de-burring, finishing and all close corner work, Foredoms have no equal! That's why hundreds of war plants throughout the nation are equipped with Foredoms, using them for solving many production and maintenance problems, spotting them at convenient points about their plants for regular and emergency service. Among the great industries that now use Foredom Flexible Shaft Machines are Ford, General Motors, Bendix, Westinghouse, Warner, Allis-Chalmers, Remington Rand, Curtiss Wright and many others. Whether your plant is large or small, no matter what materials you work with—you will find that a Foredom can help you speed up production and save money.

Our catalog No. 391, just off the press, gives the full story of Foredom Flexible Shaft Machines and shows their many uses in many different kinds of industries. Send for this catalog and find out how a Foredom can help solve today's production problems in your plant.

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FLEXIBLE SHAFT MACHINES
SOLVE MANY PRODUCTION AND MAINTENANCE PROBLEMS
FOREDOM ELECTRIC CO. 27 PARK PLACE, NEW YORK CITY

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27 Park Place, New York
Please send us your new catalog No. 391 showing the different uses of Foredom Flexible Shaft Machines.

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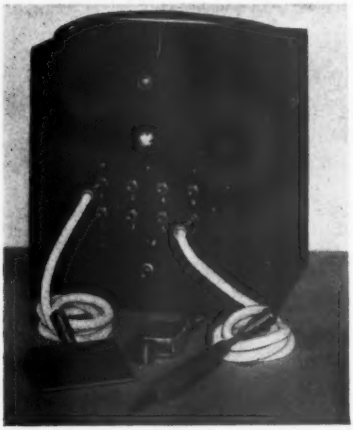


Etchograph for Aircraft and Small Tool Marking

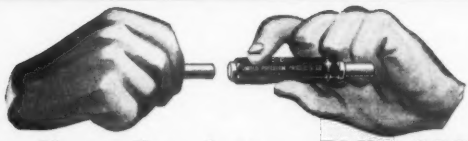
ELECTRIC etching of ferrous metal tools and parts—both hardened and unhardened—is a quick and inexpensive method for marking size, part or operation number and other identification data. Electric etching will not magnetize or damage the work. The work can be done as simply as writing with a pencil.

The Etchograph is used extensively in airplane engine plants, aviation depots, government arsenals, navy yards and small tool factories.

The standard model Etchograph will handle anything that is markable, including the hard alloys such as stellite and carboloy. The taps control the depth of the mark according to the kind of material and size of work. It is completely enclosed in a steel enameled case, which has an in-built switch for shutting off the current consumed only while the marking is being done. There is a drawer in the case to store the complete accessories consisting of two asbestos covered cables with interchangeable connectors, special alloy surface plate, solid copper quick-clip and removeable tip pencil.

Brewster-Squires Co., 44 Church St., New York, N. Y., will supply descriptive literature.

The first of a series of articles on materials handling appears on page 77. It covers the use of an overhead monorail system for handling die blocks in a die shop.



You Always Have A *New* PLUG GAGE

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DUBLIFE

REVERSIBLE

Both "Go" and "No Go" ends of DUBLIFE Gage are reversible. Turn end for end and you have NEW Gage! Plug secured in handle by bronze tapered collet. *Twice the precision life.* Accurate long after other gages are worn.

Armored against distortion by UPPCO Finish

Full line, DUBLIFE sizes .030 to 1" described in Catalog. Also other gages of American Gage Design up to 4½". Write

Originators and Exclusive Manufacturers of DUBLIFE Gages and UPPCO Finish.

UNITED PRECISION PRODUCTS CO.

3516 West Belmont Ave. Chicago, Ill.

Another PRODUCTION INCREASING APPLICATION . .

Gray-Mills *Portable* COOLANT SYSTEMS

Help **GOOD** *Band Saws do their* **BEST!**

Better, Faster Sawing —Less Blade Wear

Applying coolants to these band saws with a Gray-Mills S-20 Coolant System, has demonstrated production increases up to 100%, with blade life increased as much as 60%. System costs $117.50 complete.

Save Time and Tools — Increase Production

by adapting your machines for coolant cutting. You can, quickly, easily and economically with Gray-Mills Portable Coolant Systems. For instance; the three metal cutting band saws, above, were equipped for using the advantages of coolants by attaching a simple coolant return pan upon which is mounted a Gray-Mills pump unit.

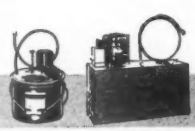
All types of machine tools for drilling, tapping, cutting, milling, honing, belt grinding, sawing, etc. are working faster and better with coolants applied by Gray-Mills Coolant Systems.

If you want to modernize older machines—equip small, large or special tools for greater efficiency—or have a standby system for emergency—Gray-Mills Coolant Systems are the answer. They are available in the gear pump type with capacities up to 165-gal. per hour or the centrifugal type with controlled flow from 1 to 1000-gal. per hour. Prices range from $39.50 to $132.50. Call your distributor for complete details or write direct. GRAY-MILLS CO., 211 W. Ontario St., Chicago.

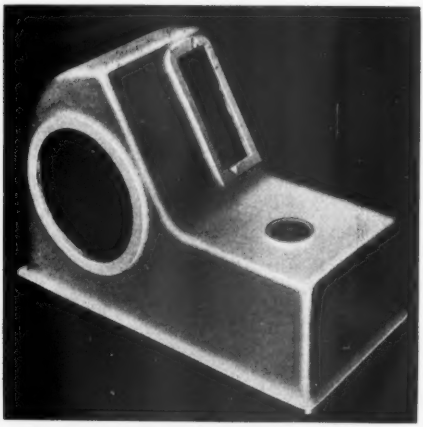
GRAY-MILLS

Gray-Mills Flo-Bac No. 5 Saw-Kut is a special coolant blended specifically for metal sawing work. It assures top cutting efficiency when used in Gray-Mills Coolant Systems.

COMPLETE PORTABLE COOLANT SYSTEMS



Capacities 50 to 1000 G.P.H.
Pressures 8 to 150 lbs.



New Metal Working Technique

A typical example of the use of new metal working techniques is shown, left. It is a housing for an electrical Shadowgraph arsenal scale, fabricated from sheet steel by the Bargar Sheet Metal Company of Cleveland. It previously was made of an aluminum casting.

When the war made aluminum scarce and the utmost speed necessary, the manufacturers turned to sheet metal fabricating to solve the problem. Production was speeded up, because no pattern-making, mold-making, pouring or cooling were necessary. Steel plates were cut to shape and welded in much less time than castings could be made.

Then it was discovered that the sheet-metal fabricated housings were better than the original castings, because they were stronger and could not brack or be broken, they eliminated all machining by the manufacturer, and they required no preparation for painting or finishing. This is due to the fact that the sheet metal used in fabricating is smooth and free of scale, and will take any finish in its natural state.

The fabricating process can be applied to practically any part which can be hollow or have thin walls, and thousands of other parts now made by slower, less efficient methods.

Free descriptive literature and engineering service are offered by the Bargar Sheet Metal Company, 12405 Euclid Ave., Cleveland.

LIMA GEARSHIFT DRIVES
Engineered for Performance
They are engineered for fast, precision production and to increase operator efficiency and accuracy. That is why LIMA Gearshift Drives are playing such an important part in machine tool and production equipment operations today.
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LIMA, O. U. S. A.

We invite a forward-looking

MACHINERY MANUFACTURER or INVENTOR

to plan with us NOW for post-war expansion

War work has caused us to greatly increase our productive capacity. So when peace comes, we will have the equipment and trained personnel to manufacture not only our regular line of wrapping machines, but other types of machinery or devices. You may find it profitable to take part in our planning for such post-war expansion.

For 30 years we have been one of the leading makers of packaging machinery. Our machines are used by hundreds of concerns — in the food, drug, candy, tobacco, dairy fields, etc. Many of the advancements in mechanical wrapping now widely used were conceived by our Engineering and Designing Department.

For war, we have *designed and built* large groups of armament machines such as cartridge loaders, cartridge-clip loaders, machines to insert cartridges into cartons, linking machines for machine-gun bullets, etc.

We are now working on ideas to expand our regular line of wrapping machines and to add other lines of machines used by industries we do not now serve.

● You may have ideas for new machinery which need development. We will be glad to discuss them with you, and if mutually satisfactory, will develop them with you.

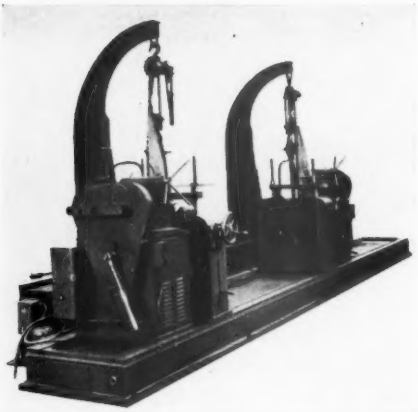
● You may have a machine or machines which you have been making in your own plant, but which might be improved and made with greater profit in ours.

Final arrangements may result in your coming into our Company—or may be worked out on some other desirable basis.

If you feel that you have something on which we might work together, we suggest that you communicate with us, giving full particulars. We can then arrange for a meeting.

PACKAGE MACHINERY COMPANY

Springfield, Massachusetts



Centering Machine for Both Ends of Work

A new machine for centering both ends of large work, such as gun forgings, will accommodate work up to 14" in diameter and up to 19' in length. This machine freely suspends the work in slings, permitting it to be easily and quickly adjusted into position by means of two davits, each equipped with a chain hoist. This method of suspension permits locking the centers in the approximate center of gravity of the piece. This is a marked improvement over the old method of obtaining a geometric center.

While the work is freely suspended in the slings, a vertical line is scribed across each end by means of a square resting on a surface plate. The work is then slightly rotated in the slings by means of a chain wrench and another vertical line is scribed across the ends. The intersection of these lines clearly and definitely indicates the center of gravity. After the centers are thus located, the work is lowered into the V-blocks of the two work supports.

The work supports have horizontal and vertical adjustment to properly position the center scribed on the end with the centering tool. Each centering head is provided with two spindles, one for a starting tool and the other for the final centering operation.

Kent-Owens Machine Co., Dept. J, Toledo, O., will supply details.

Vest Pocket Size
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Speed Production Thru Education of Personnel

This Amazing Chart Makes Trigonometry Easy

40 equations quickly found. Eliminates errors. Determines angles & dimensions, without knowledge of higher math.

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"We have found CMD Helical Groove Centers and CMD Center Point Lubricants the only solution to our problem of tooling stainless steels and chrome alloy steels. These hard metals expand so fast and the heat is so intense that we were always breaking centers or fusing them into the work. With CMD Helical Groove Centers and Lubricants, we have completely eliminated this difficulty."

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(Name on request)

The **exclusive** left-hand **helical groove** in CMD Centers eliminates galled and burned-out center points because it conveys constantly to the extreme point of the center an abundant supply of lubricant . . . CMD Lubricant withstands pressures greater than 50,000 pounds per square inch.

Write for FREE Sample Kit

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Dept. 2-TJ, 1928 West 46th St., Chicago, Ill.

☐ Send circular on CMD Helical Groove Centers
☐ Without obligation to us, send FREE sample kit containing a tube of CMD CENTER POINT LUBRICANT and a tube of CMD CENTER POINT LUBE (grease) with directions for making an amazing, simple test.

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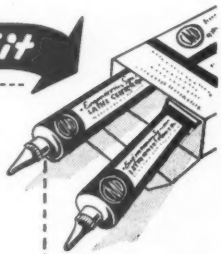


Multi-Au-Matic Combines Many Machining Operations

LESS time in which to produce larger volumes of work make necessary now, more than ever before, multiple spindle multi-production manufacturing equipment. Due to the more severe schedules of production, machines must be designed and built to withstand the strains of higher speeds, heavier feeds, tougher work materials and continuous operation.

This specialized machine is designed and built for machining all classes of castings, forgings or cutoff bar stock. It handles boring, turning, facing, threading, grooving, drilling or any combination of operations performed in sequence simultaneously with the loading and unloading of work, thereby producing a completely finished piece in the time consumed by the longest single operation, plus a few seconds required for the indexing of the carrier and its spindles from one station to the next. A cylindrical base serves as a massive and rigid surface plate on which is mounted the machine proper.

Feed work units are so designed, that by means of change gears, widely variable and independent spindle speeds may be obtained in each work station. Each tool head has independent feed works and convenient manual control.

The Bullard Co., Bridgeport, Conn., will send Bulletin D at your request.

EASTERN
COOLANT PUMPS

PRODUCTION TOO VITAL . . .

to risk the waste of time and metals because of faulty coolant handling.

Depend on the "assured-flow" of Eastern Coolant Pumps to handle your coolant compound—the flow starts with the touch of the "Go" button.

These features guarantee smooth operation with a minimum of maintenance:

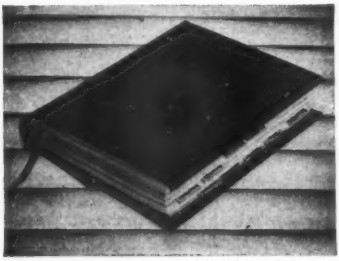
- Open-type impeller providing adequate clearance for passage of chips and abrasives.
- Motor armature, shaft, and pump impeller is an integral unit, assuring perfect alignment.
- Large down-flow intake port eliminating any possibility of pump becoming airbound.
- Bearings above the fluid level where they cannot be affected by abrasives in the coolant.

For complete details write

EASTERN ENGINEERING CO.
72 Fox St. New Haven, Conn.

SHOP AIDS

1943 PLASTICS CATALOG—The rapidly expanding plastics industry is well covered in this latest edition (864 pages) of the Plastics Catalog.



A special section, "Plastics in War," heads the contents of the new catalog. Applications of plastics in every arm, branch and bureau of the Government having any relationship with the plastics industry are shown in detail.

The "Molding and Fabricating" section contains a comprehensive article on **Types of Molds** by Gordon B. Thayer, Saran Development Laboratory, Dow Chemical Co., who also serves as Technical Consultant for plastics editorial material appearing in the Tool & Die Journal.

Like its predecessors, the 1943 Catalog is a single encyclopedia of every phase of plastics and their uses. Starting out with a general section on the plastics industry, it covers the history of plastics, production statistics and other data.

NEW METHOD BOOKLET—Newly developed equipment incorporating the use of surface coated abrasive belts for producing faster and better finishes is described in the booklet illustrated.

The method utilizes a newly perfected segment face contact wheel and surface coated abrasive belts. One's present lathe can be used or a complete backstand idler unit may be acquired for this work.

This equipment is proving a decided time saver for grinding, finishing or polishing a wide variety of pieces.

Any firm interested in pushing production may obtain this booklet without charge by writing Minnesota Mining and Manufacturing Co., Dept. NR1242, St. Paul, Minn.

3-M METHOD OF POLISHING AND FINISHING
using 3-M ABRASIVE BELTS . . . and SEGMENT FACE CONTACT WHEELS
MINNESOTA MINING & MANUFACTURING CO.
SAINT PAUL • MINNESOTA

HANDBOOK FOR WARTIME CARE OF CENTRIFUGAL PUMPS—has just been released in further recognition of the great and growing contribution of maintenance to the war effort. Pumps are being pushed far beyond normal capacities, and many pumps that worked 1800 hours in a peacetime year are now working 8700 hours a year. Consequently, a new standard of pump care has been set forth in this handbook as a necessary solution.

Valuable wartime tips included in the book describe: how a change in liquid can affect a pump; easy ways to find leaks; common mistakes in packing stuffing boxes; how tight is "too tight" for a gland; quick diagnosis of pump ills and many others.

The new manual applies to all pumps and contains no advertising. Copies can be obtained free of charge by writing the Tool & Die Journal.

KENNAMETAL CATALOG—Specifications and prices of Kennametal steel-cutting carbide tools and blanks are covered in a new catalog.

Complete in every detail, this catalog contains large halftone illustrations of each standard type Kennametal tool. In addition, typical applications of each style of tool are illustrated by line drawings. Several pages are devoted to the selection and design of tools and blanks, chip breaker designs, correct grinding, boring tool setups and other engineering data. A visual index makes it simple for the reader to find information relative to the exact type of tool in which he is interested.

Copies of Catalog 42V will be forwarded upon request to the McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

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• Saves urgently needed man-hours
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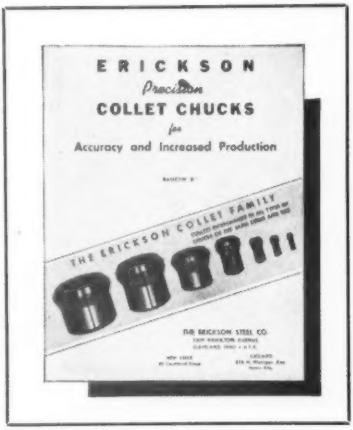
ELEMENTS OF SUPERVISION — Thoroughly familiar with the problems involved in providing well trained supervisors and foremen to industry, the authors, Professor Spriegel and Mr. Schulz, have written this book based on a sound combination of theory and practice. The book contains the basic knowledge a good supervisor should have to direct, control and coordinate the combined efforts of men, machines and materials. In the words of the authors: "Primarily, the job of training supervisors in the principles of human engineering is one of indoctrination—making them management conscious, training them in the methods of formulating sound judgment, guiding them in the application of principles to their own problems and following up to see that they practice what they are taught."

It will prove of benefit to executives, industrial officials, teachers of new supervisors and to the men on the job. Price, $2.25.

PRECISION COLLET CHUCK BULLETIN—Experience gained by leading industries in the use of Erickson Chucks under wartime production has resulted in improvements providing greater accuracy and accelerated production.

Bulletin D clearly outlines the new models, various types of equipment, actual operations and other helpful information. Over 35 illustrations are used for clearness and to save reading time.

A copy may be secured by addressing the manufacturer, Erickson Steel Co., 2309 Hamilton Ave., Cleveland, Ohio.



SCREW THREAD MANUAL—This new book, by F. J. Camm, will be found of the greatest use by those actually engaged in screw thread production, and also by designers, draughtsmen, foremen and executives. Thread milling, thread grinding and photometric systems of measurement are fully dealt with including details of screw thread production in the lathe, by means of collapsible die heads and taps, by rolling and other processes. Fifty-nine pages are devoted to screw thread standards in common use, giving tables of their proportions in the various sizes. Price, $2.75.

HOW TO SEAL CORRUGATED SHIPPING BOXES—The Hinde & Dauch Paper Co., Dept. TJ, Sandusky, O., have available a convenient vest-pocket size booklet to help any manufacturer ship their product more effectively and economically. Delivery of merchandise in A-1 condition constitutes a must to speed the war effort. After the war it should still be a must for every concern interested in serving their customers to the best of their ability in order to retain goodwill.

These booklets full of "know how" for shippers will be sent on request to readers of the Tool & Die Journal.

Permanently mark Tools, Dies, Parts, Gages, Etc. with
IDEAL METAL ETCHER
NEW 14 HEATS

New, All-Purpose Etcher for permanently marking smooth-surfaced iron, steel, and their alloys. Etches legibly, easily, permanently, regardless of the hardness of the metal. Ground clamp for etching large, heavy parts and castings.

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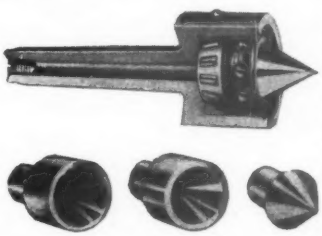

TAKE DEEPER CUTS AT HIGHER SPEEDS
On lathes, millers, grinders, etc.
Save set-up time. 3 interchangeable inserts to meet the needs of all centered and uncentered work. Fitted with high precision radial ball bearings and tapered roller bearing.
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Unusual Shapes Milled on Versatile Machine

THE Cincinnati 28" Series Vertical Hydro-Tel Milling Machine combines maximum rigidity of structure, almost effortless manipulation, extremely efficient spindle drive and independent and non-related power feeds for table, cross slide and vertical spindle carrier.

The machine comprises a fixed height box section bed supporting a sliding table; a rear base which contains the principal hydraulic pumps and tank and supports the cross slide unit; and a vertical spindle carrier unit mounted on the face of the cross slide.

In addition to supporting the table, the front bed contains the lubricating system for the table and cross ways; the mechanism for table traverse and cross traverse. The table ways in the bed are lubricated with filtered oil circulated by a motor driven pump and tank unit in the right hand end of the bed.

Guided on flat, square gibbed ways, the table has sufficient bearing area to keep the unit pressures within a safe limit even for the highest loads and cutting pressures. Permanent flatness of the table top is maintained by its surface plate design. Accurate motion in a fixed horizontal plane is assured by the long support afforded by the bed bearing.

The cross slide unit contains the spindle drive motor, spindle speed change unit and vertical ways lubricating system. It also supports the spindle carrier and the extra at-

Single-Point
DIAMOND•TOOLS

While octahedron diamonds give entire satisfaction for truing and dressing of most grinding wheels, "Ready-Set" Diamond Tools, containing an elongated stone that may be completely consumed without resetting, may be profitably used on certain operations. Catalog on request.

J. K. SMIT & SONS, INC.
157 Chambers Street, New York

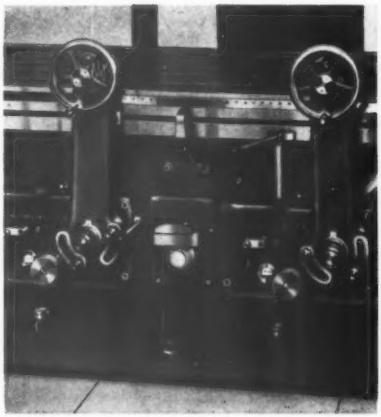
tachments required for automatic feed and depth control of the cutter. Square gibbed ways at the front of the cross slide support the spindle carrier. These ways are automatically lubricated by a gravity system, which constantly receives its supply of oil from a built-in pump.

The spindle is mounted on four anti-friction bearings. The two at the spindle nose are widely spaced to assure stiffness. The two top bearings are mounted to permit axial expansion or contraction of the spindle.

The lower end of the spindle unit is designed to receive universal milling attachments, high speed attachments and similar units. This arrangement greatly extends the versatility of the Hydro-Tel for milling unusual jobs. For example one machine equipped with an index milling attachment mills the dovetail slots in half-round bearings for marine propeller shafts.

Table and cross traverse controls, feed change dials and master control switch for all motors are conveniently grouped, as noted in the illustration, top, right. The cross slide and table feed change dials are graduated in inches per minute. Hand table traverse is regulated by the right handwheel which operates a control valve from a nut on a screw underneath and running the full length of the table. The screw, always in tension to promote accurate adjustments, does not move the table, but merely supports the nut for the controlling valve.

The Cincinnati Milling Machine Co., Cincinnati, O., will send descriptive literature and further details on request.



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Maintaining highest efficiency in YOUR cutting tools to prolong tool-life and insure constant high production rates means one thing: Grind 'em frequently. KEEP 'EM SHARP!

Here is YOUR answer to that problem.

MODEL 4 COMBINATION CHIP BREAKER AND TOOL GRINDER

Hammond offers YOU many different types in its wide line of Carbide Tool Grinders for rough and finish grinding, and the grinding of chip breaker grooves into Carbide Tools. Each type is modern — with up-to-the-minute features.

Act now — write for complete information. Hammond Grinders will help you maintain that high efficiency so necessary in the speeding-up of YOUR Arms Production.

"Beat that Delivery Promise" with Hammond Grinders and sharper tools. ASK FOR BULLETIN 201.

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★ ★ ★ 1631 DOUGLAS AVENUE ★ ★ ★

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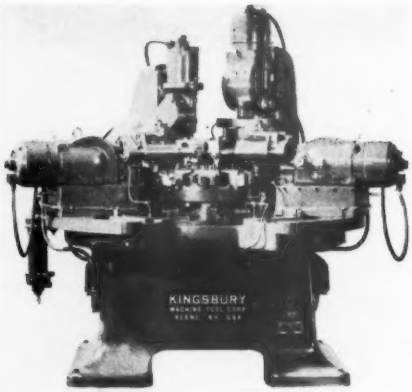
EASTERN BRANCH 71 W. 23rd STREET, NEW YORK CITY



Fleximatic Features Single Chucking of Work

THE Fleximatic is an automatic indexing machine for performing various machining operations in a single chucking of the work. Basically, the Kingsbury Fleximatic consists of a base upon which is centrally mounted an indexing turret and a number of metal cutting units. The turret is constructed to receive a number of duplicate work-holding fixtures and is capable of intermittent rotation to present these fixtures successively to the loading and working stations.

At the same time that the operator is removing a finished part and replacing it with a rough part at the loading station, the other parts on the turret are being operated upon automatically by drills, reamers, taps, counterbores, spot facers, hollow mills, milling cutters and similar tools. Since all these operations occur simultaneously during the loading and unloading, the total production time for any piece is actually no more than the longest single operation.

The indexing units consist of a turret on the upper side of which the work fixtures are secured by cap screws and button dowels. This turret has an accurately fitted center bearing for annular location and a carefully scraped thrust bearing of ample area located near the periphery to absorb vertical tool thrusts.

The index drive mechanism is designed for mounting in various locations with re-

(Cont'd on Page 151)

Maximum Tool Life *plus* Maximum Production —Use CROBALT!

● A superior heat resisting chromium-cobalt-tungsten high speed cutting alloy. Permits higher speeds with longer tool life.

Eliminates the possibility of chipping. Combines maximum production with minimum cost per piece.

Catalog rushed on request . . .

Write Dept. F

CROBALT INC.
ANN ARBOR, MICHIGAN

CROBALT

New Compass For Drawing and Scribing Small Circles

A NEW and radically different drop compass has recently been developed which answers the problem of scribing and drawing small circles. Metal workers and draftsmen have for years found the scribing of circles from a few thousands to $\frac{5}{16}$" radius difficult.

The toolmakers' compass was designed to overcome this difficulty encountered in attempting to scribe small circles with dividers. According to the manufacturer it completely solves this problem.

The proper method of using the toolmakers' compass is to make a center point at a desired position with the scriber. Then hold the compass pivot needle in the center with the first finger and rotate with the thumb and second finger as shown in the illustration.

Draftsmen will discover that tilting the compass makes it draw and eclipse. This characteristic makes it possible to blend curves with tangents when the center is slightly out of position.

The pencil adaptor which is also furnished gives the toolmaker a handy compass and furnishes the draftsman with an improved rivet compass.

The compass points are sharp and in order to protect fingers it is advisable to remove the center when changing from the scriber needle to the pencil adaptor and vise versa.

For complete information and prices, write Ithaca Scientific Instrument Co., Dept. TJ, Ithaca, N. Y.

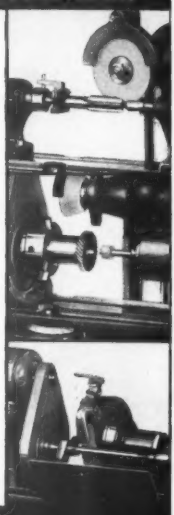
(Cont'd from P. 150)

spect to the table, depending only on the base used and the requirements of the work.

Kingsbury Machine Tool Corp., Dept. F-2, Keene, N. H., will supply data.

ROTOREX
UNIVERSAL GRINDER

Designed specially for *The Modern Tool Room*



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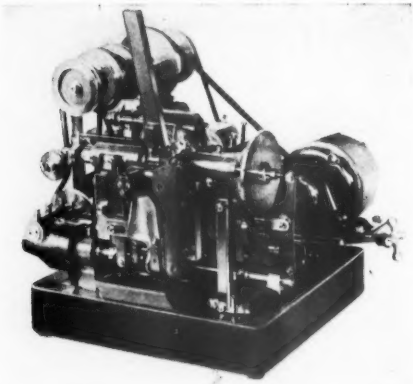

Pinion Cutter Adaptable For Gear Cutting

WALTHAM Machine Works has made a pinion cutter for many years, but only recently found that the machine formerly used almost exclusively for cutting pinions could be used for cutting teeth on sectors, slotting ends of tap screws, milling flutes on small taps, milling grooves on special scoring tools, milling flats and squaring ends of taps or rods.

The movement of the Waltham pinion and gear cutting machine is controlled by a worm and gear driven cam shaft. A track cam with a throw of 1¼" and a quick return operates the work slide. For steel work, this return is made in one-fifth the time taken by the cut. For brass the proportion is three-fifths. The connection of the slide to the cam lever is through an eccentric pin that may be turned, providing adjustment of the stroke to the position of the work. The position of this pin determines the length of the stroke.

The indexing cam has a throw long enough for a six-division index. The indexes, about 5" in diameter, are positioned on the back end of the work spindle. The minimum number of divisions obtainable is six; the maximum, 120. The indexing of the work is done during the return motion of the work slide, while the cutter is lifted from the work.

Waltham Machine Works, Dept. PG, Waltham, Mass., has descriptive literature which is available on request.

IN PRODUCTION AS IN BATTLE
It's the Result that counts!
YOU DEMANDED IT . . . .
WE MET YOUR DEMANDS
YOU wanted an 18" Duro Drill Press. Easy and Simple of Operation.
YOU wanted Ruggedness to stand constant service. also ¾ drilling capacity.
YOU wanted weight flexibility and smoothness of power to give vibrationless performance.
WE have met all your wishes in this new massive 18" Duro Drill Press and we know the results will satisfy your most exacting demands.
DURO METAL PRODUCTS CO.
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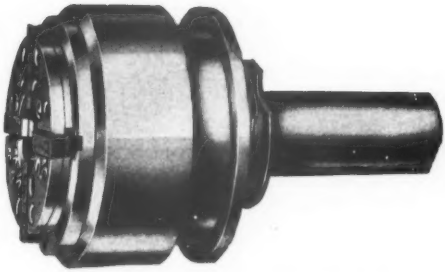
DURO FOR DURABILITY

Geometric Die Heads



A UNIQUE feature of Geometric self-opening die heads is that no solid face plates are used. The chasers protrude through the front of the head, making possible close-to-a-shoulder threading without removing face plates and without the necessity and expense of buying projection chasers. Complete chaser interchangeability from one style K head to another is offered.

A positive opening device, known as the spool trip, gives the head no chance to miss the catch and ruin the work or the machine. The trip flange is opened and closed by a single yoke and, once set, opens at precisely the same instance on every thread.

Positive locking and long wearing qualities are assured by the broad locking surface on the pawl of the KD head. The face plates, which are segmental and removable, may be taken off, trued on a surface grinder and screwed back in place, having been restored to their original accuracy.

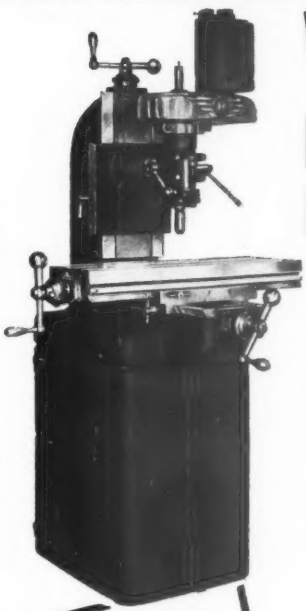
The KD head is simple in operation. After a yoke, set at a predetermined point, stops the advance of the trip flange, the thread's lead causes the chasers to advance until the locking pawl is completely depressed. This in turn unlocks the die head. At this point, the springs in the closing sleeve, aided by the bearing angles on the chasers themselves, push back the closing sleeve and trip flange, releasing the chasers from the work.

Address Geometric Tool Co., Dept. K-2, New Haven, Conn., for additional data.

HOLLAND 8"x16" VERTICAL

Slow-High Speed

MILLING MACHINE



IMMEDIATE DELIVERY

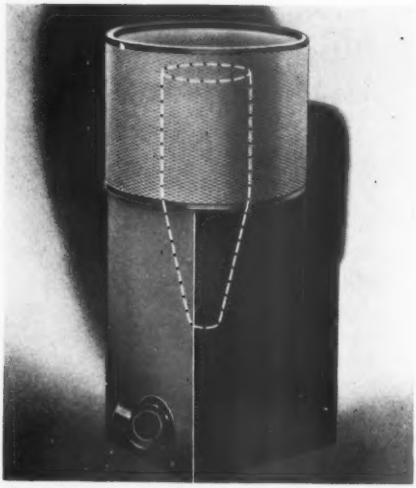
Widely used in aircraft plants and toolrooms, this miller features an unusually wide range of speeds. The high-speed head, with reduction drive, permits speeds from 200 to 4375 R.P.M., and convenient controls make the Holland efficient, easy to operate. Note unusually heavy table construction.

Ideal for sensitive drilling, high-speed end-milling and slow-speed boring. Also used in small parts production. Write for complete specifications and details.

★

MARBURG BROTHERS INC.

88-92 West St. New York



Dust Collector Features Cyclone Action

A NEW cyclone-filter type, self-contained dust collector has been added to the line of Dustkop dust collectors manufactured by Aget-Detroit Mfg. Co. Its capacity of 1250 cfm is adequate to exhaust the dust-laden air from large wheel buffers, polishers and grinders or from small wheel equipment when the latter are grouped.

The collector, known as Model 1250, employs a cyclone (indicated by dotted lines in the illustration) to collect the greater percentage of dust and dirt drawn in. So effective is the design of the cyclone that virtually all the dust and dirt is removed from the air and deposited in a removable container. The air then rises through the top of the cyclone and is returned to the working space after it has passed through the drum-shaped spun glass filter, where it receives a final cleaning.

Since the floor space required is approximately 20" x 28", the unit can be placed between alternate machines in a row of precision type surface grinders without necessitating the moving of the grinders.

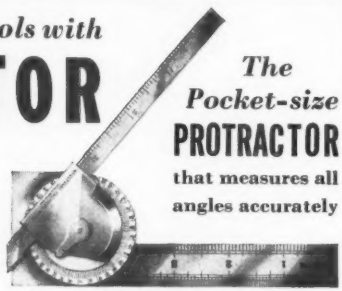
The use of the cyclone and filter in combination has most of the advantages of a centralized system without the cost of such an installation.

Address Aget-Detroit Mfg. Co., 2064 Book Tower, Detroit, Mich., for further information.

Save your Tools with

XACTOR

Insure Greater Efficiency



The Pocket-size

PROTRACTOR

that measures all angles accurately

NOW INDISPENSABLE TO THE CHIEF ENGINEER, RESEARCH ENGINEER, TOOL GRINDER, MACHINIST

XACTOR measures directly any surface angle, large or small, such as are ground on cutting tools, without the aid of attachments.

Quickly measures tapers on shallow blind holes or tooth angles on broaches, simply by sliding the Arm to suit your conditions.

Degree-graduations are arranged so the component angle is read directly, as well as required angle.

No clamps, no projecting set-screws, or other clamp-devices. Fits your vest pocket nicely. Ready for instant use.

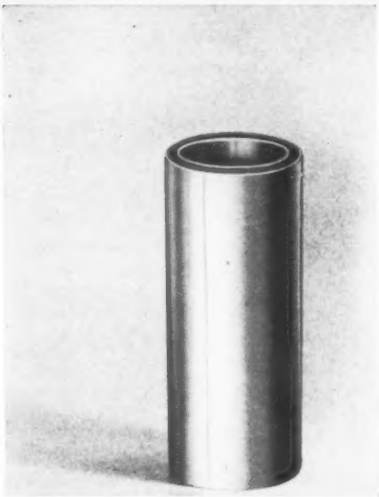
Write for fully illustrated circular.

INDUSTRIAL ENGINEERING CO., Inc.

141 West Jackson Boulevard, Chicago, Ill.

Can be purchased at Machinists' Supply and hardware dealers in United States and Canada.

New Bushing Uses Less Rubber



AN entirely new line of rubber insulated bushings, capable of absorbing vibration and shock and of taking torsional and radial movement without lubrication, are now being manufactured and distributed by Bushings, Inc. The bushings are said to save from 60% to 80% of the rubber in one important application alone; and from 10% to 20% of the amount usually required for bushings of the conventional design without reduction of efficiency or life.

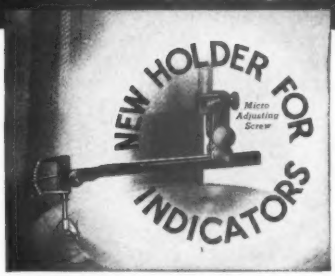
The bearings, known as Rubberflex, employ a thinner layer of live rubber or synthetics than commonly used. Peculiarly, the thinner wall increases the life and efficiency of the assembly, it is reported.

Simplicity of manufacture, permitting a wide range of sizes and capacities to suit individual requirements without costly tooling charges, consists essentially of "shooting" the rubber bushing between an inner and outer metallic member. The rubber bushing is of greater OD than the outside cylinder and smaller than the inner cylinder. Moreover, the relative resistance to slippage on either inner or outer cylinder can be increased or decreased as required.

The bushings are currently being employed as insulating backing for all needle, babbitt, bronze and powder bearings. In this type of application, the rubber absorbs shock and allows misalignment while protecting the bearing itself against damage.

Address Bushings, Inc., 3445 W. 11 Mile Rd., Berkley, Mich. for further details.

Save 60% TIME
spent adjusting indicators



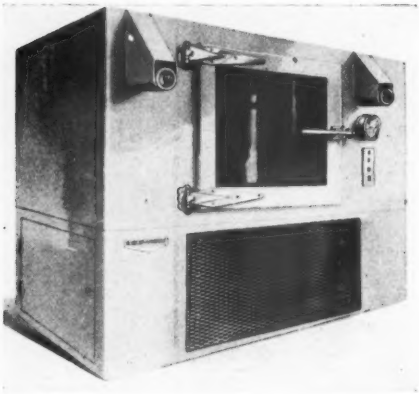
For Jigborers, Boring Mills, Milling Machines. It fits all popular indicators. The above illustration shown complete with extension bar.

NO more tiresome tapping your indicator into position. Now — after locking to approximate position, you obtain final setting by simply turning Micro Adjusting Screw. This exclusive, time-saving feature of the OSLUND HOLDER for all popular indicators gives you ***complete control.*** Write today for details.

ANOTHER TIME-SAVER

This Holder produced by makers of Oslund Indicators — the shockproof, constantly accurate indicator, whose 360° dial is read from *all* sides. Write Oslund today.

Oslund TOOL & DIE CO.
14 Sigourney St. Hartford, Conn.



Hi-Low Machine for Aircraft Inspection

THE new Kold-Hold "Hi-Low" machine, offered in three temperature ranges for the testing of aircraft instruments, batteries, wire, metals and various devices, provides the conditions required for testing under certain stringent aircraft inspection and testing specifications.

Temperature ranges are from −60° F, −80° F, and −90° F to +170° F. The condensing unit is 4, 7½ or 10 hp, 2-stage, air-cooled, "Freon-12 or 22" machine as specified. Temperature recording and controlling instruments are provided to meet usage requirements.

For the "Hi" side of the machine, strip heaters are located in the air stream for defrosting and rapid heating. For the "Low" side, finned type coils are used. The forced convection air distribution provides a high degree of air circulation in working space for rapid heat transfer.

Outside dimensions of the "Hi-Low" machine are: height, 84"; depth, 52"; and length, 94". The net clear usable working space is 46" x 36" x 36". Insulation is 8" of Fiberglas in the sides, top and bottom.

Kold-Hold Mfg. Co., 445 N. Grand Ave., Lansing, Mich., will send complete details.

BLADES FOR CENTERLESS GRINDERS
. . . TIPPED WITH TUNGSTEN CARBIDE
Assure Greater Production and Accuracy in the finish grinding of bullet cores, armor-piercing shot, shells, projectiles, tank parts, aircraft engine parts, rifle and machine gun parts.
TALIDE
METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

PUBLICATION PREVIEWS

Sales and Technical Literature

Send Request on Company Letterhead

RUSNOK MILLING AND DRILLING ATTACHMENT—This motor driven attachment is especially designed for heavy duty and mill operations. It can use many types of cutters on a great range of work. Rusnok Tool Wks., 4840 W. North Ave., Chicago, Ill., will send a broadside describing and illustrating this attachment.

LIGHT DUTY GEAR FINISHING MACHINE—Manufacturers of small gears will find new descriptive Bulletin No. 861-42 on Michigan Tool Company's light duty gear finishing machine of special interest. Design and operating features of the machine, its scope and speed of operation are contained therein. Specifications included cover the range of gear sizes that can be handled, cutter sizes, drive motor data and overall dimensions. Address Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich., for your copy.

TOOLS BY WILLEY'S—Catalog No. 26 shows but a few of their many sizes and shapes. Diagrams of each series and a chart giving tool number, shank and tap size and quantity prices are included. In addition, recommendations for grinding Willey's tools are given. A copy of Catalog No. 26 is available from Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich.

REEVES MACHINE TOOL DRIVE—comprises a symmetrical, compact assembly of constant speed drive motor, variable speed unit and mounting bracket which can be easily and quickly attached to most machine tools by means of four cap screws. The drive offers infinite speed selection. Descriptive Bulletin RT is available from Reeves Pulley Co., Columbus, Ind.

SOUTH BEND TURRET LATHES—Bulletin 1004 describes in detail and illustrates the No. 1003-2 and No. 1004-2 turret lathes. A table gives capacity, spindle speeds and general specifications of both turret lathes. Address South Bend Lathe Works, Dept. 802, South Bend, Ind., for your copy of Bulletin 1004.

AUTO ENGRAVER—engineered for rapid commercial and industrial engraving, is best fitted for medium heavy work. Round or flat surfaces may be engraved. Progress while engraving may be accurately checked by simply rotating stylus arm without disturbing work. Auto Engraver Co., 364 Fifth Ave., New York, N. Y., will send descriptive folder at your request.

"HEAT TREATMENT IN ELECTRIC SALT BATH FURNACES"—a 20-page booklet with detailed illustrations, shows modern installations of the immersed electrode (Ajax-Hultgren) salt bath furnace with the self-circulating, self-heating feature. It may be used for all the hardening processes, including high speed steel tools, carburizing, neutral hardening, heat treating aluminum alloys, selective heating, annealing, brazing, and armament applications. Operating principles are discussed. Address Ajax Electric Co., Inc., Frankford Ave. at Delaware, Philadelphia, Pa., for your copy of Catalog 107AT.

FOSDICK JIG BORER—The simplicity of this machine enables a drill press operator to perform accurate work on jigs, fixtures and miscellaneous production parts. A detailed description of the jig borer is given in Catalog JB. Fosdick special equipment is also illustrated and described. Fosdick Machine Tool Co., Cincinnati, O., will send a copy.

YOST VISES—Catalog No. 11, available from Yost Mfg. Co., Meadville, Pa., profusely illustrates their line of vises. Included are toolmakers, drill press and machinists vises. Complete specifications and prices are also contained in Catalog No. 11.

DEGREASING MACHINES—A 24-page, two-color catalog on Detrex Solvent Degreasing equipment presents in an interesting and easily understood style first hand information on all phases of this rapid metal cleaning method. Interesting adaptations of various kinds of conveyors installed in Detrex degreasers are described in detail. Detrex alkali, emulsion and spirits washers and Triad alkali cleaning and stripping compounds are also covered. Address Detroit Rex Products Co., 13000 Hillview Ave., Detroit, Mich., for your copy.

STELLITE CUTTING TOOLS—a new publication, lists the sizes and prices of 84 standard square and rectangular tool bits and 74 varieties of welded-tip tools—all made of 98M2, the recently announced nonferrous cutting tool material. Recommendations regarding grinding wheels for use on tools made of this alloy are also presented for hand and machine grinding operations. Haynes Stellite Co., Dept. H1, Kokomo, Ind., will send Form 5783 at your request.

SUTTONIZING—A new and timely 27-page catalog containing 88 pictures of the new Suttonizing welding method for the reclamation of high speed steel tools is announced by Welding Equipment & Supply Co., 223 Leib St., Detroit, Mich. Reclaimed cutters, reamers, and broaches are depicted.

Intricate Compression Die

made in 3 operations . . .

CASE HISTORY No. 8: After the blank is bored and the design scribed on its surface—a roughing and finishing cut is made with the SLOTMASTER. The finish cut is held to one and two thousandths, and so accurately done, it was found that when checking the die by rotating the lapping punch from position to position, it could be pressed through the die in any position . . . The lapping operation requires a man's time only for set-up. It is started by lowering the punch to the mouth of the die opening and then setting the down stroke of the Slotter so that it will completely compress the coil spring. As the spring relaxes, the punch works its way through the die as a result of the spring pressure and the stroking of the Slotter.

SLOTMASTER can be used on any round or flat-on-round over-arm milling machine and will do precision work that normally requires a multi-thousand dollar machine (all of the working parts are of tool steel, heat treated). It takes but little time to change over from one head to the other . . . the stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s.p.m. The tool holder is of the clapper box type and can be turned in any position. SLOTMASTER comes complete with pulleys, motor, mounting bracket, etc.

Send for 4-page catalog—give specifications of the milling machines you wish to equip. Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE CO.

12609 GREINER
DETROIT, MICH.

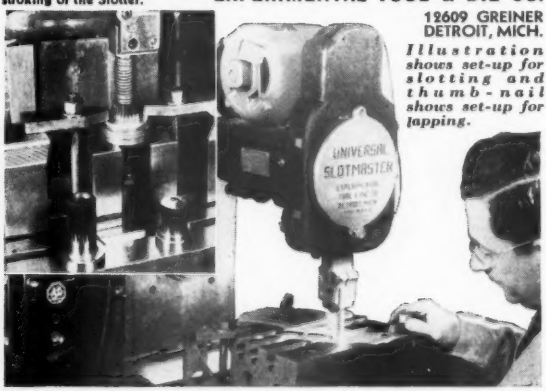


Illustration shows set-up for slotting and thumb-nail shows set-up for lapping.

"SECOMET DIAMOND WHEELS"—a comprehensive booklet, listing many types and sizes of resinoid-bonded and metal-bonded diamond wheels. Available on request by addressing J. K. Smit & Sons, Inc., 157 Chambers St., New York, N. Y.

"THEY USED THEIR HEADS"—This well illustrated booklet gives a detailed account of how production experts, in order to break bottlenecks, have adapted Black & Decker and Van Dorn portable electric tools to fill in equipment gaps or to perform new and unprecedented wartime functions. Copies are available by writing The Black & Decker Mfg. Co., Dept. 2-J, Towson, Md.

ROUSSELLE ADJUSTABLE SPACERS—Saving hours on "straddle-milling" setups is the theme of a new bulletin just issued by the David J. Ross Co. on their adjustable spacers. A wide range of sizes makes them adaptable to all standard milling machines. The David J. Ross Co., Benton Harbor, Mich., will send this bulletin on request.

STAR PRECISION DRILL GRINDER—Interesting photographs and explanatory captions presented in Folder SJ show this grinder in actual use. Specifications are given. Address Star Machine & Engr. Corp., Bloomfield, N. J., for a copy.

ALEMITE LUBRICATING EQUIPMENT—A feature of Catalog 22-49 is a quick, comprehensive selection guide for determining the lubricating equipment best adapted to many lubrication requirements. The equipment is charted in accordance with the kind of lubricant pumped, container capacity, operating power and pressure. Described in the catalog are stationary and portable power guns, lubricant loaders, transfer pumps and all types of manually operated greasing equipment. This illustrated catalog may be obtained from Alemite Div., Stewart-Warner Corp., 1820 Diversey Parkway, Chicago, Ill.

"ACCURACY IS OUR CREED"—This motto of the Perfex Gage and Tool Co. is explained in a new circular released by this company. In addition, a partial list of Perfex gages are illustrated. Perfex Gage and Tool Co., 3604 Gaylord, Detroit, Mich., will send a copy of this circular on request.

NEW HARDINGE CIRCULAR—Descriptive literature, specifications and price lists on the Hardinge Brothers' line of Precision Power Spring Collets and Feed Fingers are now available. The four-page bulletin will be of particular value for users of Brown and Sharpe machines. For your copies, write Hardinge Brothers, Inc., Elmira, N. Y.

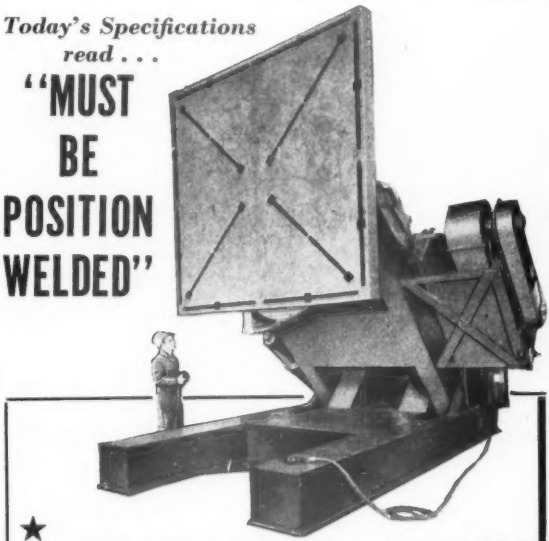
SUNNEN MODEL "MA"—A new precisely illustrated booklet giving complete operating instructions for the Sunnen Model "MA" precision honing machine has been recently published. This handy booklet has been made available by Sunnen Products Co., 7947 Manchester Ave., St. Louis, Mo. Send for your copy today.

DESPATCH RECIRCULATING FURNACES—Bulletin 81-T on furnaces for heat treating ferrous and nonferrous metals is now available from Despatch Oven Co., Minneapolis, Minn. The bulletin is complete with suggested uses, complete range of sizes and construction specifications for standard and special models. Many features are listed that insure better furnace performance. The new, high temperature, heavy duty Despatch furnace and indirect gas heating systems are illustrated. Also explained are ingenious material handling systems that allow more satisfactory handling of aluminum castings as illustrated in the aluminum furnace section.

CENTER SCOPE BOOKLET—Full of case histories and application pictures, it interprets the method of optical locating and centering with the Center Scope. Address Center Scope Instrument Co., 351 S. LaBrea Ave., Los Angeles, Cal.

Today's Specifications read . . .

"MUST BE POSITION WELDED"



★

To guarantee flawless welds, stronger unions and smoother, cleaner fillets, buyers of welded products today specify, "must be position welded." The greatest advance in welding technique, position welding, not only assures a better product but reduces spoilage and rejects, cuts actual welding time by permitting the use of larger rods, and cuts crane, crane crew and welders handling and set-up time to a fraction. ***On a C-F Positioner weldments and assemblies can be welded down-hand on ALL sides with a single set-up,*** **can be revolved completely around and tilted to any point up to 135° from horizontal. C-F Positioners come in capacities from small hand operated positioners to large variable speed giants that twist and turn 30,000 lb. weldments under push button control.**

Write for Bulletin WP 22

CULLEN-FRIESTEDT CO.,
1316 S. KILBOURN AVE. CHICAGO ILLINOIS

AIRCRAFT TOOLS—A new 1942-43 catalog on cupforged, comparameter inspected, microglass polished precision aircraft tools, developed by Aero Tool Co. in cooperation with leading aircraft manufacturers is now available. The "years ahead design" tools are profusely illustrated and described. Specifications and application data are included. Address Aero Tool Co., 227 W. Olive St., Burbank, Cal.

DETROIT TAPPING MACHINES—An 8-page bulletin covering its new line of high precision tapping machines has been released by Detroit Tap & Tool Co., 8428 Butler St., Detroit, Mich. An outstanding feature contributing to the precision of the machine is the provision for the drive to the tap at the base of the lead-screw. Thus the normal windup in the lead screw is eliminated.

STERLING GRINDING WHEELS—A series of four booklets on toolroom, cylindrical, portable and centerless grinding, discuss in detail the various types of grinding with Sterling wheels. Wheel marking analyses charts are included. The series is offered by Sterling Grinding Wheel Div., Cleveland Quarries Co., Dept. TD, Tiffin, O.

CINCINNATI MILLING MACHINES—Combining a high rate of productivity with extremely accurate performance and ease of handling, Cincinnati No. 0-8 plain automatic milling machines are especially profitable for the milling of small, intricate parts produced in large quantities. Such parts include those for the manufacture of small arms, business machines, electrical devices and similar mechanisms. Catalog M-964-1 profusely illustrates these machines. Dimensional drawings and tables of specifications are included. Address Cincinnati Milling Machine Co., Dept. CT, Cincinnati, O., for your copy.

FLATNESS and SMOOTHNESS
of Production Parts
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
Ultra-Lap MACHINE COMPANY
245 McDOUGALL AVE. · DETROIT, MICH.

"WET DRY BELT SURFACING"—This booklet contains valuable information on a new method of wet abrasive belt surfacing and it is creating much interest in metal, plastics and other industries. The contents are authentic as they are based on actual jobs now in operation in hundreds of plants both large and small. A copy will be sent upon request by Porter-Cable Machine Co., Dept. TD, Syracuse, N. Y.

DOUGLAS #1 ROTOREX GRINDER—The Rotorex #1 Universal Tool and Cutter Grinder is now available for early delivery. To acquaint shop men with this grinder, a new descriptive circular and price list No. 65a has been issued. Copies can be obtained by writing Douglas Machinery Co., Inc., 150 Broadway, New York, N. Y.

TUBING AND PIPE PROTECTION METHODS—An attractive booklet lists 13 concise reasons why seal-caps and seal-plugs are effective in protecting sealing tubing, threaded fittings and hydraulic units. Well illustrated with application photographs, this book will prove of interest to men in toolrooms and die shops. Address Tubing Seal-Cap, Inc., 215 W. Seventh St., Los Angeles, Cal., for your copy.

CUB VARI-SPEED TRANSMISSIONS — A new broadside issued by Standard Transmission Equipment Co., 3401 Verdugo Rd., Los Angeles, Cal., describes and illustrates the Cub transmissions. Operation and construction features are discussed in detail. Selection tables are given. Send for your copy.

HEIM DIE POLISHING MACHINE—A brief description of the Heim machine and its die polishing method is the subject of Circular HP6. The method discussed, it is claimed, results in a fine finish and increases die life. Copies are available from The Heim Co., Dept. JP, Fairfield, Conn.

ELECTRIC FURNACES—Many industrial plants, finding their commercial heat treating equipment capacity exhausted, have installed inexpensive equipment to handle the heat treatment of small parts. This line of small electric furnaces is described in Bulletin No. 50 which is available from Cooley Electric Mfg. Corp., 215 S. Senate Ave., Indianapolis, Ind.

"HOW TO MAKE YOUR STANDARDS LAST LONGER" — The importance of making all gages last longer cannot be overemphasized. The Dearborn Gage Co., as a service to the users of gage blocks, is offering a new booklet to stress the proper care of gage blocks to insure longer life. It is available from Dearborn Gage Co., 22034 Beech St., Detroit, Mich.

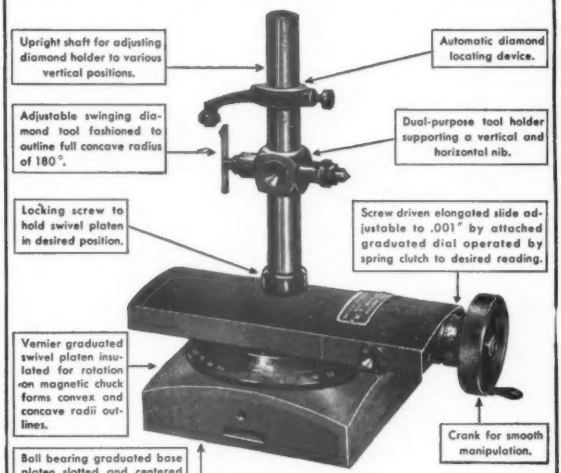
VICTORY TOOL SHANKS — A new bulletin is now available describing the complete line of Victory Tool Shanks. It explains what they are, what they offer, how they are finished, if they need special care and the special shapes that are available. For your copy of Bulletin No. 52T-1, write The Cooper-Bessemer Corp., Sugar St., Mount Vernon, O.

WATER HARDENING TOOL STEEL—Described in Bulletin 642 is Jessop RT Tool Steel which is suited for many applications where toughness and strength are particularly required. Physical properties and tempering range charts are included. Address Jessop Steel Co., Dept. J, Washington, Pa., for your copy.

HARDSTEEL DRILLS—A combined catalog and instruction book issued by Black Drill Co., 5005 Euclid Ave., Cleveland, O., will prove of value to the men in tool rooms and die shops. Illustrations show Hardsteel in drills, reamers, tool bits and special tools in war production work.

"23 WAYS TO CONSERVE THE LIFE OF V-BELT DRIVES"—was prepared by the Multiple V-Belt Drive Association, 134 S. Dearborn St., Chicago, Ill., to educate power users in the proper procedure of selection, installation and maintenance of drives. A copy is available free of charge.

Keep Wheels Grinding For Victory


Upright shaft for adjusting diamond holder to various vertical positions.
Automatic diamond locating device.
Adjustable swinging diamond tool fashioned to outline full concave radius of 180°.
Dual-purpose tool holder supporting a vertical and horizontal nib.
Locking screw to hold swivel platen in desired position.
Screw driven elongated slide adjustable to .001" by attached graduated dial operated by spring clutch to desired reading.
Vernier graduated swivel platen insulated for rotation on magnetic chuck forms convex and concave radii outlines.
Crank for smooth manipulation.
Ball bearing graduated base platen slotted and centered for flexibility of installation is simply and quickly mounted.

MEYERS "DIA-BRASIVE"

Radius-Angle Former Speeds Precision Grinding

● **Fashioned for simple and speedy installation on various machines, this precision tool eliminates lost motion in grinding production by making possible speedy, precise radial and angular forming of grinding wheels from any angle. Engineered for dependable service. Write for literature and prices.**

W. F. Meyers Co., Inc., Dept. T, Bedford, Ind.

Aggressive Mfrs. Rep. wanted in East, West and South

Atlas Coolant Pumps Adaptable to Most Machine Tools

Atlas Press Co., 212 N. Pitcher St., Kalamazoo, Mich., will send further details.

ATLAS coolant equipment can be adapted quickly and easily to all makes of lathes, drill presses, millers, grinders, cut-off saws, screw machines, single and multiple spindle drilling and tapping machines.

Atlas coolant pumps are designed on the centrifugal principle, which permits the control valves to be closed completely while the pump is operating. Simply turning the control valve adjusts coolant flow from drip to strong washing action. A four-bladed impeller, driven directly by the extended motor shaft, is the only moving part below the motor. This simplicity of construction increases rigidity, lengthens service life and insures smooth, trouble-free performance.

Pump motors have been designed especially for smooth continuous operation with Atlas coolant systems. They are completely enclosed and not affected by moisture or caustic solutions.

Atlas coolant pumps are equipped with heavy gauge steel tanks. Openings are provided for pump unit, feed and return tubing.

Turn to page 68 for the aircraft industry's solution to the deep drawing of metal parts.

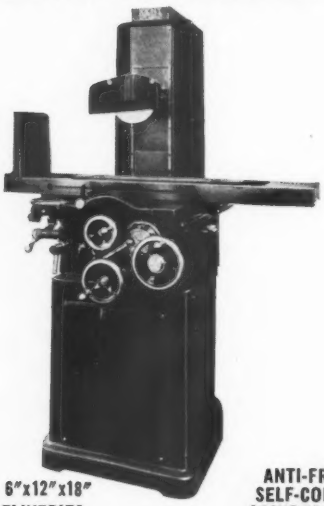
A handle at each end of the tank simplifies moving and reinstalling the coolant system. Two lugs are provided for installing the tank permanently.

Atlas coolant systems reduce tool wear and improve work finish. They are easily adaptable to almost any machine tool.

ATLANTIC

No. 2 Automatic Precision

SURFACE GRINDER



CAPACITY 6"x12"x18"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
GRINDER SPINDLE

ATLANTIC MACHINERY CORP.

149 Broadway New York, N. Y.

(Continued from Page 114)

For the past several months the National Safety Council has been feeling out the national accident situation. A network of liaison with Government agencies, with private industry and over a hundred private organizations, has been set up. And now, with the decks cleared for action, and armed by voluntary contributions through the War Production Fund to Conserve Manpower, the Council is in a position to make real progress in tracking down manpower losses through accidental death and injury.

Licking the American Accident Plague

William A. Irvin, national chairman of the Fund and former steel executive who has emerged as the Nation's spokesman for safety in America, will visit areas hampered by accidents in turning out the tools of war with maximum efficiency. He will be accompanied by Colonel John Stilwell, president of the National Safety Council, and other representatives of that organization.

Local safety leadership will be enlisted among business men, industrialists, union heads and the municipal authorities in each center visited. Each city will be offered the full aid of the National Safety Council in curbing its accident toll. The aim is to make a double-barreled attack on accidents. The Council will serve as consultant and overall coordinator. The community will organize and get to work to route out accidents on the spot where they occur.

"To lick the accident problem there must be centralized leadership with complete technical resources," Mr. Irvin explains. "This leadership will be provided by the National Safety Council —the general staff in our campaign. At the same time there must be combat troops, led by men who know the terrain. Here local leadership comes in."

(Continued on Page 164)

Don't be "stumped" if the specifications call for

DRILLING HARDENED STEEL

● You can do it! HARDSTEEL Drills enable you to drill, counterbore or enlarge holes in hardened steel by the same methods you would use on soft steel, and *without annealing any portion of the piece.* A remarkable time-saver! Write for illustrated instruction booklet.

We can fill your requirements for Die Springs, Dowel Pins and all other Die Maker's supplies.

DIE SUPPLY CO.

J. R. Fitzsimmons W. H. Fitzsimmons Jos. T. Fitzsimmons

4751 Hough Ave., CLEVELAND, O., EXpress 1133

INDUSTRIAL DIGEST

(Continued from Page 163)

The five-weeks' swing around the country began January 17 from New York. It will include stops at St. Louis, Chicago, Minneapolis, St. Paul, Seattle, Portland, San Francisco, Los Angeles, San Diego, Dallas, Ft. Worth, Houston, New Orleans and another city to be designated.

In cities where there are local safety councils, they will be asked to enlist as charter members in the National Safety Council's revised wartime organization. This will provide a permanent framework for a nation-community plan of action. Where no local safety council exists, committees are to be organized which in time can develop into full-fledged safety councils in their own right.

Once community leaders have accepted responsibility for safety within their war production area, the community drive will get under way. A frontal attack will be made on industrial, public school and home hazards, with the aid of Council experts.

Intensive community drives will be organized at once to get the continuing program off to a flying start. Industrial management will be asked to cooperate in stepped-up safety instruction courses.

The school superintendent and the teachers will be asked to stir up lasting concern for the safety of children, on which hangs the morale of war worker families. Children, as well as citizen volunteers—perhaps block wardens—may be given home hazard check lists to take into the home for careful filling out. Safety for women, women war worker fashions and safety devices and the hazards of the unprotected war worker home will be dramatized for the benefit of 4,000,000 women to be recruited in war industry in 1943.

Once it gets under way, to keep community safety at a high pitch it is planned to have monthly safety meetings of management-labor committees. Regular safety meetings may be scheduled for foremen and workmen. Special plant protection measures may be worked out by community safety leaders with the representatives of the OCD, the FBI and the War Department.

Sharp Tools Wear Longer . . . Do a Better Job

SAVE YOURS with

QUEEN CITY GRINDERS

BALL BEARING BENCH, PEDESTAL and DISC TYPES

Tool grinding is only one of the many jobs handled efficiently by Queen City Grinders.

They are built in a complete range of sizes in bench, pedestal and heavy duty box type bases in units from 1 H.P. to 10 H.P.

These grinders are powerful—sturdy units equipped with two Carborundum wheels, one coarse, one fine—safe enclosed wheel guards with built in exhaust—Allen Bradley push button switch with overload protection—adjustable and safe work rests—tool tray—water pot—adjustable, shatter proof, clear glass eyeshields.

All Queen City Grinders come fully equipped with grinding wheels, ready for immediate use.

The initial cost is also comparatively lower than most grinders.

QUEEN CITY DEALERS at your Immediate Service

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Indianapolis Machinery & Supply Co.	Indianapolis, Ind.
James W. George Machinery Co.	Detroit, Mich.
Eichman Machinery Co.	Kansas City, Mo.
McDonald Machinery Co.	St. Louis, Mo.
Cincinnati Machinery & Supply Co.	Cincinnati, O.
Hess-Schenck Co.	Cleveland, O.
E. W. Smith Machinery Co.	Columbus, O.
C. H. Gosiger Machinery Co.	Dayton, O.
Elyria Belting & Machinery Co.	Elyria, O.
State Machine Tool Co.	Milwaukee, Wis.

QUEEN CITY MACHINE TOOL CO.

218 EAST SECOND ST. CINCINNATI, OHIO

Mr. Irvin and his colleagues will arrive with a definite plan for putting all these urgently needed measures into effect at once. The broad idea is to get safety started on a basis of community participation with local leadership, Fund financing and National Safety Council guidance. From the original 14 war production centers it is expected the idea will spread to other centers and spill over into the farms, where accidents are a threat to the dwindling labor supply.

Under-secretary of Navy Forrestal, in coming out strongly for the campaign against accidents, called for more teamwork in the community to ensure maximum support of the fighting forces. "Our first job is to make weapons," Mr. Forrestal said. "Any impediment to their manufacture in this time of national crisis comes strictly under the heading of criminal negligence bordering on sabotage."

The national safety movement, headed by Mr. Irvin, has semi-official status, since by Presidential proclamation the National Safety Council was asked to use every means at its command to reduce the accident toll. Donald Nelson, chairman of the War Production Board, and Lt. Gen. William Knudsen at different times have lauded the work of the Council and its Fund.

"We in America have been the most careless of all countries in use of our material and human resources," Mr. Irvin said. "Only Chile outstrips us in accidents. About one year after Pearl Harbor more American workers had been killed by accident, either on or off the job—46,300 all told—than men, women and children in Great Britain by German bombs up to the first of the year. In addition 4,000,000 workers were injured, 165,000 of them permanently. This adds up to 450,000,000 man-days lost. Anyone can see that we in the safety movement have a job on our hand, a job that will take plenty of will-power and money to complete. But we are confident of the outcome."

Mr. Irvin and Colonel Stilwell are convinced that a national safety movement adequate for a war period depends first on making the problem understood, then on getting cooperation, American style, on a community basis.

PAYS FOR ITSELF ON A WIDE RANGE OF WORK

HIGH SPEED
VERTICAL MILLING MACHINE
AND
JIG BORER

GREATER IN RIGIDITY
Supreme IN ACCURACY

Improvements incorporated in this machine greatly extend its utility. Bigger jobs can be handled, more clearance has been provided for fixtures and table has been re-designed for greater rigidity.

The Improved Linley is unsurpassed for small jig, die and fixture work of all kinds as well as for pattern and layout work. Its simplicity, speed and accuracy contribute to its utility and economy. Availability of correct speeds reduces tool breakage to a minimum.

Features include ball bearings throughout and a micrometer screw feed grill and depth stop gauge which makes it possible to machine to pre-determined depths accurately without first resorting to pencil figuring.

CONDENSED SPECIFICATIONS
Table Size—7 in. x 17½ in.
Tee Slots—3
Table travel (long.)—10 in.
Table travel (cross)—6 in.
Table top to spindle (Max.)—11½ in.
Spindle speeds (8) 275 — 4250 R.P.M.

Write at once for a copy of Bulletin M giving complete details.

LINLEY BROTHERS CO.
662 State Street Extension
BRIDGEPORT, CONN. U. S. A.

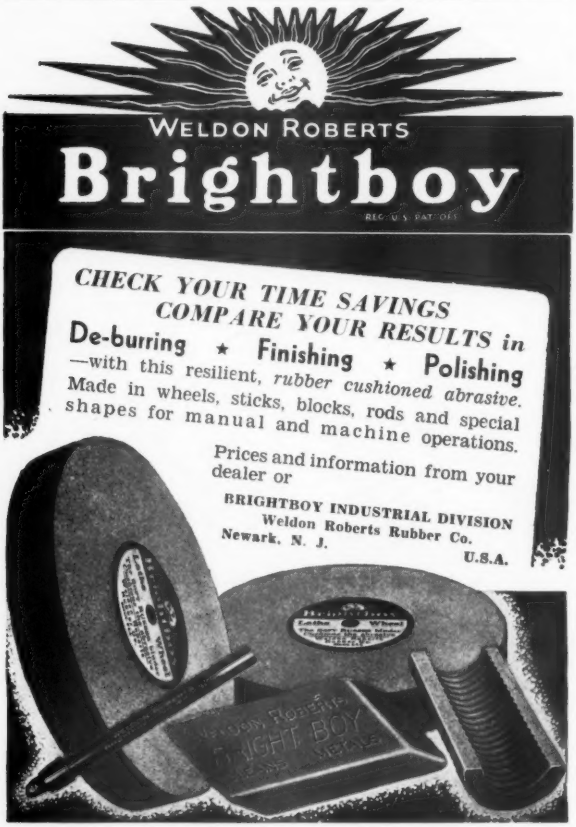
Precision Die Making Discussed

Precision die making and precision die making machines were the subjects of talks delivered recently by Richard F. Moore, president, Moore Special Tool Co., Inc., of Bridgeport, Conn., and J. Robert Moore, production manager of the Jig Borer Division.

With "Precision Die Making" as his subject, Richard Moore discussed the dies designed and furnished by his company for the manufacture of the M-43 Mechanical Time Fuze. He emphasized the high degree of precision necessary in the fabrication of a die designed to stamp a large number of holes and slots to close tolerance in a thick piece of metal. To illustrate, he referred to the ten-station progressive die provided for one of the time fuze parts. A complex bit of clockwork, which fits into the nose of the shell, the fuze must be so accurately made that it will detonate the charge exactly at a predetermined instant.

J. Robert Moore, speaking on "Precision Die Making Machines," pointed out that interchangeability of machine parts depends upon high precision, which is achieved by means of the accurate tools, dies and gages used in forming and checking the critical shape and dimensions of each part. As a result, machines on which such tools are produced must be even more accurate.

The Moore jig grinder, a new addition to the machine tool family, was only recently developed by Moore. Until recently, distortion due to hardening was a bugaboo in the production of tools and dies for precision parts. Correcting the position of holes after hardening was a costly, highly skilled and, at best, makeshift process. The jig grinder relocates holes and finish-grinds them, straight or tapered, within .0001". Instead of grinding the holes in one section of the die at a time, the Moore jig grinder does it all in one setting.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CHECK YOUR TIME SAVINGS
COMPARE YOUR RESULTS in
De-burring ★ Finishing ★ Polishing
—with this resilient, rubber cushioned abrasive.
Made in wheels, sticks, blocks, rods and special shapes for manual and machine operations.
Prices and information from your dealer or
BRIGHTBOY INDUSTRIAL DIVISION
Weldon Roberts Rubber Co.
Newark, N. J.
U.S.A.

INDUSTRIAL DIGEST

New Salvage Division in WPB

Importance of the part played by salvage in the war effort was emphasized by Donald M. Nelson in announcing a Salvage Division in WPB under the direction of Paul C. Cabot. A year ago when the Government salvage efforts were first started, the Nation faced a critical situation in shortages of many important materials. At that time 45 furnaces were shut down because of a shortage of iron and steel scrap. These furnaces are now back in operation and none have been shut down because of a lack of scrap since last summer.

"Although current inventories of iron and steel scrap are much improved over a year ago and other salvage conditions are in better shape, it is extremely important to realize that scrap needs in the future will be greater than ever," Mr. Cabot said. "It is highly important," Mr. Cabot concluded, "to remember that our salvage duties have only begun and our salvage responsibilities for collecting it are not diminishing by what has been done to date."

Apprentice Training Program Enlarged

Every month since February, 1942, an average of 1,100 firms have been helped by the Apprentice and Training Service to organize programs to train and upgrade specialists, machine operators, single-skilled men and mechanics.

The War Manpower Commission Chairman said that "many thousands more can be added to our industries if employers, badly in need of trained workers, more fully utilize the agency and its field representatives."

FLOATING HOLDERS for Screw Machines

•

Now Available for
IMMEDIATE DELIVERY
(In Stock)

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B & S No. 00	No. 1	$6.00
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AJAX ENGINEERING & MFG. CO.
MANUFACTURERS OF HALCO PRODUCTS
14234 BIRWOOD AVE., DETROIT, MICH.

The Application of Unit Drives to Machine Tools

(Continued from Page 102)

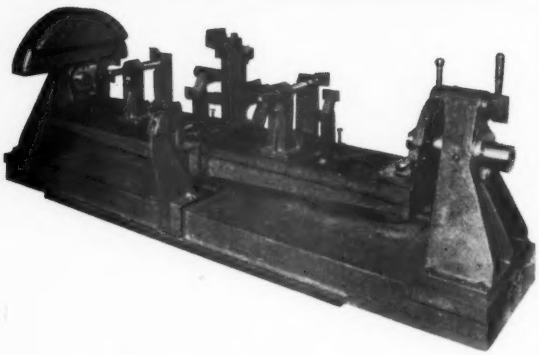
Not long after new machine tools began appearing with individual drives, the users of the older machines which were still operating on the now obsolete line shafting began looking for a way to increase shop efficiency by bringing their equipment up to date. One of the first steps in this direction was to apply an electric motor connected through an automobile transmission to obtain the necessary speed changes. The inadequacy of this solution is well proven by the relatively small number of these installations that were made. Special supports were difficult to fabricate. Special connectors had to be devised and made. Because it was not built for the job, the adapted type of transmission was inconvenient to operate, adding to its many other disadvantages.

Specially designed machine tool transmissions naturally followed this unsuccessful makeshift drive, which has resulted in the neat-appearing, orderly plant of the type shown in Fig. 1. Predesigned brackets and supports of a variety of shapes and sizes make it possible to easily and quickly install these modern individual motor drives on practically any type of machine tool.

Even in an old established machine shop that has individual drives applied, there is no longer the expensive necessity of using a motor large enough to run the entire machine shop while running only one machine. It is true that the power utilized is only the power to overcome the actual load on that one machine plus the loss through the system, but those losses are, in proportion to the effective load transmitted, very much higher.

The loss in proportionality comes largely as a result of decreased power factor which, in turn, occurs because only a small part of the total available power is actually used. Thus a vicious cycle is started that has no end. It must be remembered, also, that wherever an extra bearing or belt occurs, or wher-

We Sell Precision . .



★ Dies, Jigs, Fixtures, Special Machinery and Designing.

Hardened and Ground Parts to Order.

MASTER MACHINE & TOOL COMPANY

925 WEST NORTH AVENUE, CHICAGO, ILL.

Indirect Ejector System for Injection Molding

(Continued from Page 107)

in application to closures, flash lights and other internally threaded parts.

One type of unscrewing mold has a shaft with worm teeth that mesh with gears mounted on the core of the threaded part. The worm shaft is driven by an electric motor. Another design makes use of a sprocket drive. Here a chain driven by a sprocket fastened to a motor transmits motion to turn the sprocket attached to the thread core. Another unscrewing mold makes use of a train of gears which has a pinion gear, driving an idler gear. This in turn engages either an external and internal gear or another series of gears which are in direct contact with the core. The motor speed may be decreased by a reducer.

The operation of these types of molds is fully automatic and the variation in the cycle is small. As the mold opens, a limit switch opens a circuit, starting the electric motor to drive the gears, sprocket, or speed reducer. This action starts the unscrewing and moves the cores back into the mold until the mold itself has reached the extreme open position. Here it strikes another limit switch which closes the circuit and stops the motor. As the mold closes another limit switch reverses the motor and carries the thread plugs forward.

The Application of Unit Drives to Machine Tools

(Cont. from Page 168)

ever an extra countershaft must be installed, both friction and slippage take their toll of the available power, and operating costs will increase correspondingly.

In a subsequent article specific applications and a study of the engineering phases of this important power transmission problem will be considered in greater detail to enable the reader to judge the merits of his own particular case and to decide the best approach to obtain the desired results.

HAND CUT ROTARY FILES
for PRODUCTION SPEED-UP!
ELIMINATES HAND FILE DRUDGERY

We furnish hand cut rotary files, in any shape or size.
PROMPT DELIVERY
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ROTARY FILES are invaluable to:

MACHINISTS —in making oil grooves in bearings, etc.

FOUNDRY MEN —for filing, trimming or chipping aluminum, brass and steel castings, etc.

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Hand cut Rotary files will work on alloy steels.

DIE DESIGNING AND ESTIMATING

CONTENTS

New Chapters include:
Progressive Dies
Compound Dies
Drawing Dies

(Deep drawing section on cartridge case design, mathematical and graphical methods of determining diameters, shell wall thicknesses, punch and die sizes)

Outline of Equipment and Operations for Manufacture of Small Arms Cartridge Cases

15 New Estimating Tables

Separate Index of Time Value Tables

150 Practical Points on Die Designing and Building

★ "Will be extremely helpful to us . . . .", "very practical", "even better than I had hoped it would be"—these are comments by men in the precision tooling industry who have examined the new second edition of "Die Designing and Estimating". Orders for 50 copies (most on a second order after the book was reviewed) from a public library, 28 copies from an airplane manufacturer, 24 from an apprentice training instructor testify to the usefulness of this book. Largely written on request by specialists, the book covers its subject concisely, systematically and with authority.

The 160 pages have over 125 drawings, charts and photographs carefully selected to illustrate modern die designing practice. The estimating data (largely that of George Dannes) is complete enough to follow from rough sketch to a final, sound estimate.

Send for your copy today. Price $3.00 per copy plus postage. Write for quantity discounts.

AMERICAN INDUSTRIAL PUBLISHERS

338 Fairmount-Cedar Bldg. - Cleveland, Ohio

Surface Plate Checked with 3-Way System

THE Master Surface Plates are designed and manufactured to conform to close tolerances and to provide accurate tool inspection.

They are checked for flatness with the three-plate system of comparison—a method considered fundamental for arriving at primary standards for flatness, including optical flats. Under this method of checking for maximum tolerance, the specifications of hard-to-please users are met.

The large elliptical rib, reinforced with internal spider rib construction and supporting ribs to the outer edges, is an exclusive feature of Smith Master Surface Plates. The depth and placement of the ribs give maximum rigidity and stiffness to the plate and minimum deflection by weight of the object being measured.

These plates are precision lapped to a final flat surface and then hard flaked to prevent sticking and to allow gages to slide freely on top of the plate.

As a special service, all Smith plates which have a tendency toward inaccuracies, due to a worn surface from long usage, may be shipped back to the factory where they will be brought back to original accuracy for a very reasonable cost.

Address Smith Tool & Engineering Co., 818 N. Wingert St., Bucyrus, Ohio, for complete details.

AMIC COMPARATOR

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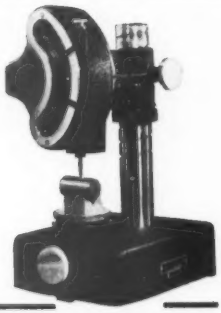
A Precision Indicating Gage



Our extensive experience will solve your measuring problems

DESIGNED to replace special gages, flush pin gages, snap, height gages. For accurate, convenient and quick checking of components, either in the tool room or on the production line. Permits precise gaging throughout the whole day without eye fatigue. Each small line on the scale represents 1/10,000th of an inch.

A REMARKABLE IMPROVEMENT

Clear reading on 6" scale, with inch and millimeter readings. Magnification is 1000.

Measuring capacity is plus or minus .003" and plus or minus .05 mm.

Pointer immediately comes to rest.

Pointer moves in the plane of the scale, thus avoiding any error in measuring due to parallaxis.

Provision for convenient lifting of the contact pin.

Two fine adjustments for easy setting.

Convenient red mark limit hands control tolerances.

Interchangeable backstops and accessories.

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240 West 40th Street New York, N. Y.

MANUFACTURERS OF GAGES, JIGS, FIXTURES AND SERVICE TOOLS

Army and Navy Specifications Consolidated

To standardize further specifications and requirements for war material used by the two Services, the War and Navy Departments have created the joint Army-Navy Committee on Specifications.

This step facilitates and increases the flow of war materials from factories and reduces all unnecessarily different specifications and requirements.

This new committee will establish joint specifications which will be known as "Jan" specifications. These are to be used for items or materials similar in technical requirements and peculiar to the War and Navy Departments.

Lubricants Prevent Overheating

CMD Lathe Center with left hand helical grooves is for the purpose of lubricating the entire surface of the work supported by the dead center on the tailstock. The grooves hold a supply of lubricant for replenishing the lubricant that dissipates on account of heat from work expansion between centers and heat generated by cutting tools. The left hand helical grooves further prevent lubricant from dripping or being forced out of the work.

This center, when used with CMD lathe center point lubricants, has an operating ratio of from 15 to 1 running time over the conventional type of lathe center. The center, when used with CMD lathe center point oil as a lubricant, can be used for either slow or high speed work.

CMD lubricants are economical because only one application is necessary. No time is lost in relubrication. Galling and burning of lathe centers is reduced. These lubricants can withstand pressures greater than 50,000 pounds per square inch. They prevent overheating and annealing of center points, speed up work and permit heavier cuts in machine operations. Finer tolerances may be had because the lathe centers may be drawn up snug against the work, thus eliminating any chatter marks.

Details may be obtained from Chicago Mfg. & Distributing Co., Dept. J-1, 1928 W. 46th St., Chicago, Ill.

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MOTOR DRIVES GET

Work Done FASTER

STEP UP production 25%. Modernize your lathes, screw machines, shapers, punch presses, milling machines and similar equipment with CULLMAN Drives. Available for motors ranging from ¼ to 15 H.P.

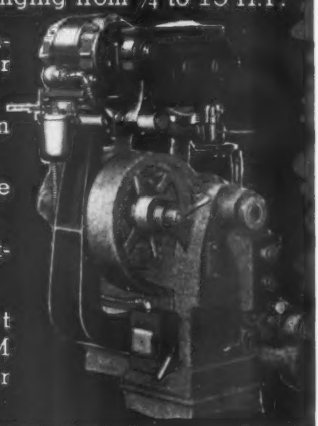
Gives instant control and greater output.

Can be installed in a short time.

Affords belt-drive smoothness.

Permits better lighting.

The war effort needs MAXIMUM output. Write for the full facts.



CULLMAN WHEEL COMPANY

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Metallizing Electrically Made Possible with Fuse Bond Process

A new Fuse-Bond Process and equipment for its application has been announced by Metallizing Engineering Co. The main advantage of the process is that it affords an adequate bond on the hardest surfaces, heretofore impossible or impractical to prepare by blasting or rough threading. It also simplifies the preparation of narrow edges, flat areas and cylindrical parts having keyways and other interruptions in their surfaces.

Application of the process is with the Metco Fuse-Bond unit. Operating on any 110 or 220 volt, single phase power line, this equipment fuses a rough deposit of electrode metal into the surface to be metallized. Electrodes are applied to the work with a special holder, which uses up to six electrodes at a time, depending on the size and nature of the part to be prepared. Small parts may be prepared with this equipment as easily as large shafts, since there is no excessive heating of the base metal.

The Fuse-Bond unit is extremely compact, being contained in a cabinet measuring only 24" high. All cables and attachments fit into a bin in the top of the cabinet. A complete Instruction Manual provides all operating data. Unskilled labor can efficiently operate the unit within an hour or so.

Further information is available from Metallizing Engineering Co., Inc., Dept. B, Long Island City, N. Y.

FOR LOWER UNIT COST ON SMALL PARTS PRODUCTION ★ ★ ★

Urgent war needs have stepped up the demand for small parts to such an unprecedented degree that large turret lathes are being tied up when they are sorely needed for heavier work. The Logan No. 830 Hand Screw Machine was developed to break this bottleneck. Engineered and built to exacting specifications, it is capable of accurate, continuous production. With a capacity of ⅝-inch round bar stock, it turns out parts with the same speed and precision as that of the larger machines. And, because its cost is low by comparison, unit production costs are further lowered.

Logan

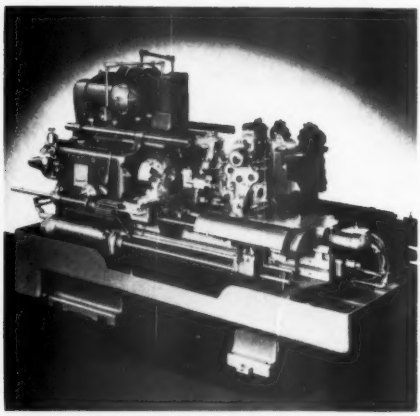
A NAME TO REMEMBER WHEN YOU THINK OF LATHES

SPECIFICATIONS
1. Swing Over Bed, 10"
2. Bed Length, 43⅛"
3. Spindle Hole, 25/32" Capacity, ⅝"
4. Preloaded Precision Ball Bearing Spindle Mounting
5. 12 Spindle Speeds, 30 to 1450 R. P. M.
6. Cross Slide Stroke, 3¼"
7. Six Position, Automatic Indexing Turret
8. Stroke of Turret, 4¼"

The Logan Bar Feed is offered as an accessory for the No. 830 Hand Screw Machine. Maximum capacity, ⅝-inch round stock. Maximum stroke 2 inches.

NO. 830 LOGAN ⅝" CAPACITY HAND SCREW MACHINE

LOGAN ENGINEERING COMPANY Chicago, Illinois



Fastermatic Turret Lathes

MAXIMUM production at a minimum of man-hours is claimed for the "Fastermatic" since the entire machining cycle is automatic and the operator need only load and unload the work.

Fastermatics are equipped with a flexible hydraulic feed system which provides an independent feed for each face of the turret. For this reason, no time is lost in changing over from one cut to another. Frequently, the same tools may remain in the turret and simply be reset for the particular work in hand. Standard tools are available for most work. Standard cams, adjustable to control the various movements or change the operating speed, are provided.

Multiple cutting and various combinations of machine movements may be readily performed by the hydraulic feeding mechanism. The Oilgear Unit, supplying the oil pressure which controls all feeding operations of the machine, is mounted in the bed below the headstock. Oil pressure adjustable from 300 to 1000 lbs. per square inch is provided and rapid traverse pressure of 300 lbs. per square inch maximum is adjusted at the factory.

All headstock gears are helical type, providing smooth, quiet power transmission which reflects itself in the finished work by the absence of gear tooth markings. All pick-off gears are likewise of helical type,

(Cont'd on Page 175)

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

DIE TABLE Filing From Below

PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this Duplex Die and Punch Filing machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular.

MARBURG BROTHERS, INC.
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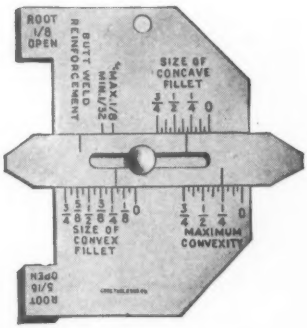
Pocket Size Welder's Micrometer



A NEW and essential welding gage, known as the Welder's Micrometer, enables a welder to meet exact specifications of butt and fillet type welds. Made in a convenient pocket size (2½" x 3"), it is handy and easy to operate. Welders can accurately check the sizes of convex or concave fillets as well as check the permissible tolerance of butt weld reinforcements.

The instrument is precision built of chromium plated steel with dimensional readings clearly indicated. From the great interest shown in this instrument, it is evident that it fills an important need in the welding industry. Thousands are now in use throughout the country helping welders in accurate calibration of welds as well as saving valuable metal.

Welding Chart M-2, illustrating its various uses and specifications for ferrous materials, is available upon request. Address Chicago Tool & Engr. Company, 8388 S. Chicago Ave., Chicago, Ill.

(Cont'd from Page 174)

heat treated and precision finished.

A powerful multiple disc clutch acts as a spindle brake when the spindle control lever is shifted to the left. This eliminates waiting for the spindle to coast to a stop and also holds the spindle while chucking the new piece.

For complete details on Fastermatic Turret Lathes address International Machine Tool Corp., Foster Div., Dept. K, Elkhart, Ind.

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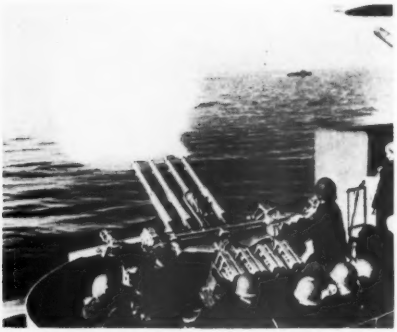

This official U. S. Navy photo shows the 1.1″ multiple anti-aircraft gun.

RECORD-BREAKING production of gun mounts carrying four rapid-fire anti-aircraft guns — the weapons which hurled hundreds of shells a minute at Japanese planes in the battles of Pearl Harbor, Midway and the Solomon Islands—has been disclosed by the Westinghouse Electric Elevator Co.

Before Westinghouse tackled the job in the summer of 1940, each gun mount required 8500 man-hours of labor and cost about $27,000—but assembly line production methods enabled the company to turn out each unit with about 2100 man-hours of work at a cost of about $12,000. Differences between estimated cost and actual cost were returned to the government. By May, 1942, they were turning out nearly 40 percent more mounts each month than their contract called for.

Guns Water Cooled

Weighing 14,000 lbs., each mount consists of an adjustable four-foot long horizontal gun support, installed in an H-shaped stand moored to a revolving steel base. Each gun support has four large grooves, 9″ by 13″, into which water cooled gun barrels are inserted. The four guns, although not synchronized, are fired in nearly simultaneous bursts by a single trigger mechanism on the left side of the unit.

Guided by sights on both sides of the unit, Navy gunners train the guns on flying targets by quickly moving them up or down and left or right. When necessary the entire mount can be swung

When days mean VICTORY call for

Johnson FURNACES

2 WEEKS DELIVERY

No. 575 Pot-Hardening and Melting Furnace

This unit is equipped with lid-lifting mechanism which easily raises the cover and locks it in UP position. It's heavily insulated with 4½″ firebrick, backed up with 3½″ insulating block. Electric ignition facilitates lighting burners, and may be used in conjunction with photo electric safety system, to provide complete protection from possible explosions due to gas failure. Vent damp regulates flow of exhaust gases. Top ring, in 3 sections, to prevent cracking or distortion. Large blower assures maximum performance. Price—$315. F.O.B. Factory (Blower Extra).

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Johnson Gas Appliance Co.

592 E Ave., NW Cedar Rapids, Iowa

Sales Offices:

Bourse Bldg.
Philadelphia

120 Liberty St.
New York City

C. B. Babcock Co.
475 11th St.
San Francisco

in a complete circle. The guns are aimed manually by a series of easy turning cranks near the sights and also by hydraulic power controls which are installed when the gun units reach a ship.

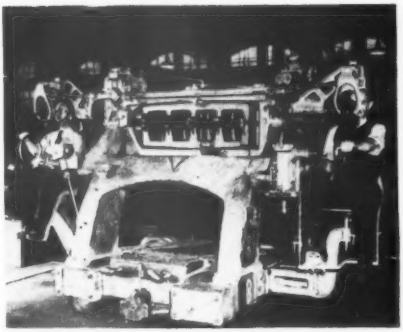
Maneuverability of the mounts depends upon precision manufacturing at extremely close tolerances. This is insured by 4800 inspections during the manufacturing process, or about six inspections for each of the unit's 800 principal parts.

"Dead Flat" Surfaces

Principal surfaces must be levelled to a point that engineers call "dead flat", with an allowable discrepancy of two-tenths of a thousandth of an inch. Other parts must be accurate within four-tenths of a thousandth to a thousandth of an inch.

Just before the gun mounts are ready for shipment, sights that are used in actual combat are installed temporarily and tested for accurate alignment with gun barrels. Maximum allowable tolerance in this test is one minute, or one sixtieth of one degree — which would result in a deviation by the gun projectiles of not more than ten and one-half inches per thousand yards.

Accuracies required for the units' flat surfaces are too delicate to be achieved by machines, so the required precision is obtained by hand scraping.



Inspectors are testing gun sights for alignment with grooves where gun barrels will be inserted.

STARRETT TOOLS *HELP SKILLED HANDS TAKE THE MEASURE OF THE AXIS*

Getting tools of Starrett accuracy and dependability into these hands has been a task worthy of the supreme efforts of every Starrett toolmaker. On that task we shall continue to concentrate our skill and experience without stint.

Your mill supply distributor is likewise doing everything he can to help you procure the Starrett precision tools you need. You may depend on him.

THE L. S. STARRETT CO., Athol, Massachusetts, U. S. A.
World's Greatest Toolmakers

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PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
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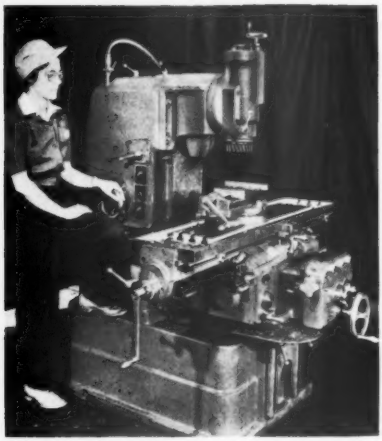

Miller Does Horizontal or Vertical Work

ONE of the wartime production machines that seems to answer the question of speed, versatility, precision and ease of operation is the Lombard 30HV, a universal type miller for either horizontal or vertical work.

Shown at the left, the machine is being used in its vertical capacity with a vise and bar setup. High, full power spindle speed is achieved by direct power gearing and double pulley V-belts. The hinged vertical head swings into position from the right. The actual change from horizontal to vertical is achieved in only a few minutes by removing the arbor support clamp and arbor, and sliding the double overarms into the column. The vertical head tapered shank fits into the horizontal spindle and is held by a draw bolt clamp. Control wheel at the top of the vertical head has selected micrometer reading which eases setup, gives instantaneous depth adjustment and allows for precision milling. In the illustration the young lady is setting the spindle speed control before raising the table to cutting position.

The illustration at the top, right, on the opposite page shows a simple straddle milling job. Duplicate controls on both side and front assure ease of operation. Everything about the machine was built for speed. After the job was set up, the operator fixed the table dog controls and control levers. The operator can check the

Sheldon BBU-1242 WQ Precision Lathe

This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1″ round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

If interested in 10″, 11″ and 12″ quality lathes be sure to see the SHELDON.

SHELDON MACHINE CO., INC.
4236 N. Knox Ave. Chicago, U.S.A.

work frequently while it is still in the machine.

On this horizontal setup, the single clamp arbor support rigidly held to the double overarms makes the spindle gear seem a permanent installation for horizontal type of work only. By two or three quick motions, releasing the arbor support and double overarms, the machine is ready to begin as a vertical miller. The vertical head, hinged to the column, swings into position with the tapered shank of the vertical head fitting directly into the horizontal spindle and held by a draw bolt holding it to the head. Bolt clamps also hold the head rigidly to the column. Full power spindle speed is made by direct power gearing with double pulley V-belts. On the vertical setup, cutter height is controlled by a micrometer reading lever at top of head, facilitating precision work without raising or lowering the table.

One thing that makes the Lombard universal particularly impressive, besides its accessibility of control, easy change and range of automatic control is the lack of lost motion in the machine itself. Main drive gears are located in the saddle immediately under the table. Short shafts are, therefore, used to advantage and high torque is produced by high gear production immediately at the screw. The ways and gibs show careful scraping, giving utmost and smoother bearing surface. All spindles are made from heat treated steel, hardened and ground. Antifriction bearings are used throughout the transmissions.

Lombard Governor Corp., Dept. L, Ashland, Mass., will send descriptive literature.

STURTEVANT
QUALITY
a complete line of Permanently Accurate
Torque Wrenches
NO FRICTION ADJUSTMENTS MOVING PARTS FRAGILE MECHANISMS
STURTEVANT
Torque Wrenches are used in leading industrial, automotive and aircraft plants to control the set of screws and nuts in production departments . . . to measure and test applied torque or resistance in laboratories and inspection departments — and for innumerable jobs ranging from building delicate instruments to checking frictional drag in giant diesel motors.
Built by the pioneer in accurate measuring wrenches, they are more accurate. They retain their accuracy permanently. Practically indestructible. They have brought to industry a new means for production control and for gauging and measuring torque in its thousands of applications.
Capacities from 0 to 7200 inch pounds
Write for Bulletin describing use of STURTEVANT Wrenches at Wright Aeronautical Co.
PA STURTEVANT CO
ADDISON QUALITY ILLINOIS

Precision PAL TOOLS Gauges

Mechanics will welcome the introduction of the PAL Precision Gauge, with improved feature of close adjustment. The PAL Precision Gauge is a dependable and handy measuring tool and is offered at a very reasonable price. • The PAL Precision Gauge is 10¼ inches in height, has a full 6⅝ inch range. It can be converted from a calibre to a height gauge in ten seconds, and has direct reading inside and outside.

The PAL Precision Gauge has many new features, including the following: — Plastic base, making it lighter and rust proof; cast iron sole plate for longer wear; detachable scriber; swift motion assembler which eliminates all thumb screws; self-locking sensitive adjustment

PAL TOOL COMPANY

2300 EAST THIRTY-FIRST STREET MINNEAPOLIS, MINNESOTA

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★ In conjuction with your gage blocks, Acme Optical Flats and Monochromatic Lamp make light-wave measurement simple and easy.

Where glass optical flats are used to determine surface flatness, or where they are used for comparison measurement in connection with precision gage blocks, light of a single wavelength is required. This is provided by the Acme Monochromatic Lamp. Its large, bright working field avoids the necessity of exact placement of the work, and makes inspection easy and fast. Interference bands can be seen on a relatively dull surface or through an appreciable air gap. This decreases scratching and wear of your glass flats as it is unnecessary to rub them down on the work to squeeze out the air film.

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ELLWOOD CITY, PA.: JOHN S. FISHER, 9 FIFTH AVE.
PITTSBURGH: L. A. REISMAN, 2035 FIFTH AVE.

Modern Milling Fixture Design

(Continued from Page 76)

teeth are ground across their faces at opposite angles; this feature forces out the chips over and under the cutters and eliminates "chip drag." A heavy flow of coolant is supplied on the cutters through a pipe partly visible behind the arbor.

The fixture is bolted on a circular rotary table. The piston heads are placed in three equally spaced stations for milling. A heavy equalizing clamp, over each station, holds the work down when the hand-wheel over the clamp is tightened. Two opposite cuts must be made in each head. After completing the first cut the work is reversed and the second cut is taken.

In the fixture under discussion, the work is placed, milled, removed, and another piece is located in a station while the milling operation is in progress on the piece ahead. The rotary table is locked in place for milling when the operator moves the crank shown above the hand-wheel. The work is fed to the cutters by advancing the table with power feed.

(Photos by Kearney & Trecker, Milwaukee, Wis.)

Deep Metal Drawing

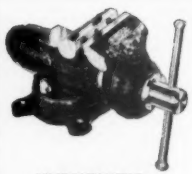
(Continued from Page 72)

A majority of the deep drawing dies used by Douglas are made of Kirksite "A" which is a special high grade zinc containing as alloying ingredients aluminum, copper and magnesium. Kirksite "A" is usually supplied in ingots weighing approximately 30 lbs. each.

Some of the larger and more standard dies are made of Meehanite. Douglas Aircraft Company have complete facilities for machining Meehanite dies. Included in the equipment are Keller duplicating machines.

"Dural" has a tendency to gall if not lubricated; therefore, the blank and die are sprayed with oil before each draw. The affinity between Kirksite "A" and "Dural" is much less than that between Meehanite and "Dural." Nevertheless, drawing oil is used on both types of dies.

Some dies at Douglas weigh as much as 23,000 lbs. To operate these dies successfully without guides calls for a press of extreme accuracy.



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5 YEAR
GUARANTEE

WILTON PRECISION VISE

REVOLUTIONARY IN THE FIELD OF VISES

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- NO SIDE TWIST OR WOBBLING
- PRECISION GUIDED STEEL KEY (at base)

Sizes 3", 4" H.D., 4½" H. D. and 6" are built to conform to Federal Specifications GGG-V-436 as required by Army, Navy, etc.

Good Delivery on most sizes

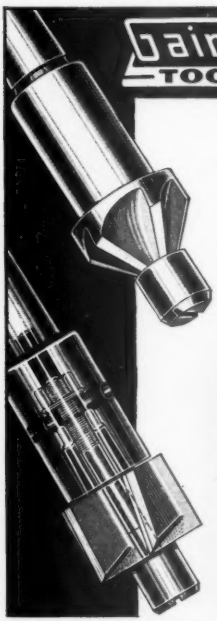
SIZES AND PRICES

WIDTH OF JAWS	MAXIMUM OPENING	APPROX. WEIGHT	PRICE WITHOUT SWIVEL	PRICE WITH SWIVEL
3"	4½"	19 lbs.	$10.50	$12.80
4"	5¼"	37 lbs.	16.40	18.60
4" Heavy Duty	7"	48 lbs.	17.90	21.00
4½"	5¼"	40 lbs.	19.10	21.30
4½" Heavy Duty	8½"	55 lbs.	23.00	27.50
5"	8½"	58 lbs.	28.00	33.60
6"	9½"	106 lbs.	48.50	62.00

Extra Jaws Available.....	3"	4"	4½"	5"	6"
Smooth, Precision Ground Steel, Hard or Soft....	$1.90	2.85	3.30	4.40	5.50 pr.
Brass or Copper, Smooth.....	2.20	3.10	3.65	5.50	6.45 pr.

Send for Precision Production Tool Catalog No. 42

ACME TOOL COMPANY 200 CHURCH STREET NEW YORK, N. Y.



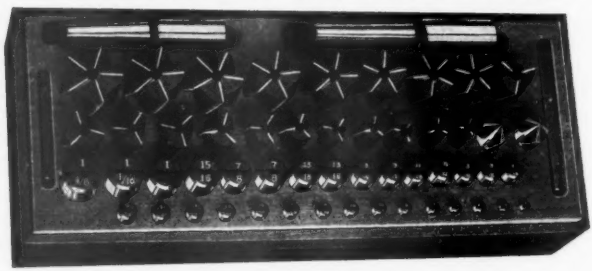
Gairing TOOLS

Counterbore Sets

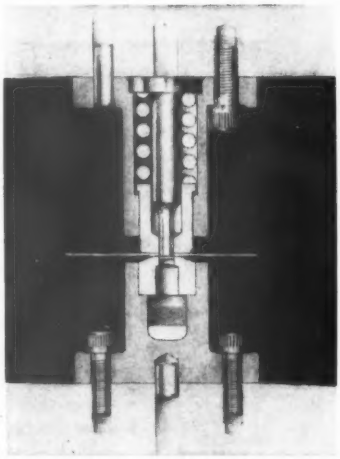
A kit of these efficient tools eliminates costly delays in counterboring and spotfacing. Seven sets from which to choose. Each contains a logical selection of interchangeable counterbores, pilots and holders. *Write for prices and Bulletin C.*

Set C-13, below, consists of 2 holders, 20 cutters ranging from $\frac{3}{16}$" to 1¾" and 28 pilots ranging from $\frac{3}{32}$" to 1⅛". Two countersinks, ⅞" x 70° and ⅞" x 82° are included, all neatly boxed with hard wood cover.

THE GAIRING TOOL CO., Detroit, Michigan



Self Contained Punch and Die Units Recently Announced



THE new Wales CD Hole Punching Units for use in conventional die sets has been announced. The CD units are sets of punch and die units. The punch unit half contains a punch with a pilot, a holder, a stripping spring and a guide. The die unit half consists of a holder with a slug clearance chute and a die.

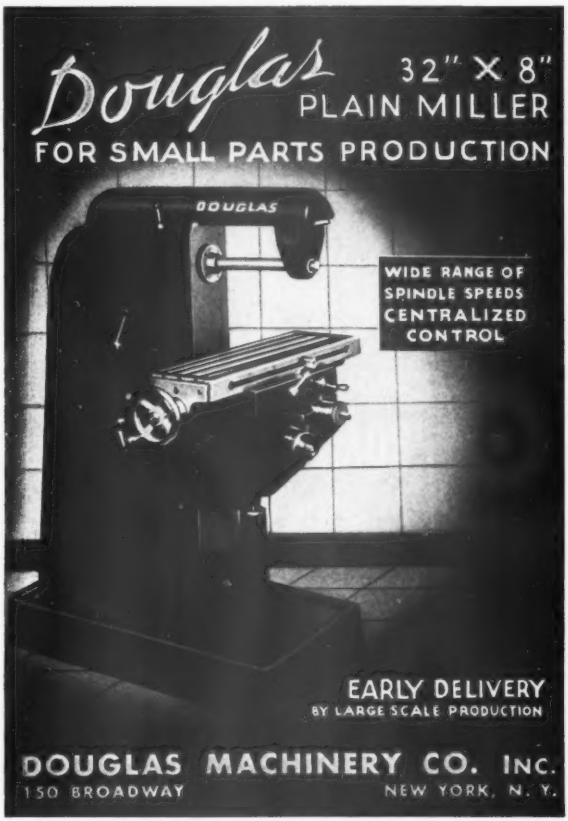
Each CD unit is self contained and independently mounted to either punch or die shoe. This eliminates the necessity of costly "down-time". There are two quick and simplified methods of mounting Wales CD units into a die set.

The customary way is to mount these units directly to the punch and die shoe.

The other method, unique in the metal working industry, mounts the units on templates which slide into position and are bolted to the shoes. Aligning the punch and die template mountings is automatically accomplished by an alignment ring that fits over the die and allows the punch to drop into it, thus aligning punch and corresponding die. By aligning one punch and one die, both punch and die templates are aligned, and after bolting into secure position on the shoes, the die set is ready to operate.

The Wales units are used in either punch presses or press brakes to punch holes from $\frac{1}{16}$" to $1\frac{1}{8}$" diameter in metal up to 11 gauge.

Complete information is available from The Strippit Corp., 345 Payne Ave., N. Tonawanda, N. Y.



BLOWS CUSHIONED with Rawhide HAMMERS and MALLETS

- Coiled Rawhide faces strike *effective* blows without marring or battering; speed up work; reduce spoilage. Hold true faces—strike accurately. Outlast several ordinary mallets. Reduce bounce and recoil—prevent fatigue. All sizes with light or weighted heads. Write for Catalog.

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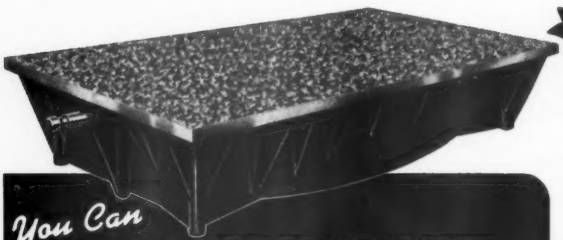

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36" x 68"

and there is a wide selection of standard sizes available ranging from 8" x 12" to 48" to 120". Smith MASTER Surface Plates have successfully met Aircraft and Ordnance specifications requiring a surface tolerance of one ten-thousands of an inch. Many plants have re-ordered several times. When your inspection or production departments demand action, you can depend on Smith's enlarged facilities for prompt deliveries. For sizes available and prices, write, wire or phone.

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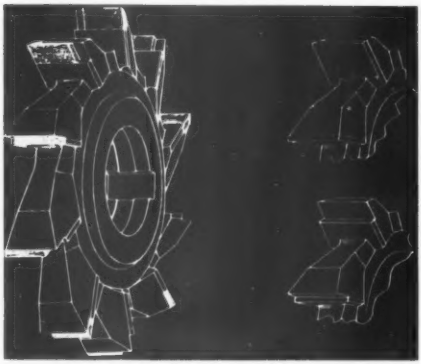
Tool Life Increased



WHEN high speed steel cutters are worn out it is not necessary to scrap them.

The simple way to reclaim these tools is to braze tips of Carboloy to the cutting surface of the tool, letting the tip project slightly beyond the edge of the tool and then grinding the tool to size. Now when the tools wear undersize—they will probably take a lot longer to do this than did the original tools—they can be brought back to size by moving the tips out slightly. To do this, heat the tips until the braze is loosened and then move them out enough for regrinding.

This tipping procedure is being currently followed for such wide ranges of tool classifications as conventional milling cutters, reamers, counterbores, side mills, core drills, spot facers, fly cutters, end mills, etc.

The illustration shows the reclamation of a double face mill. Teeth of the high speed cutter are ground down, and carbide tips are brazed to the faces. Note that tips are staggered so that every other tooth cuts on one side, and intermediate teeth on the other. Detail views show the cutter teeth before grinding and after grinding before brazing the tip in place. After brazing, the tips are ground to original cutter specifications, taking care that rake and clearance angles follow recommended Carboloy carbide tool practice.

Address Carboloy Co., 11109 E. 8 Mile Blvd., Detroit, Mich., for further details.

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TOOL AND MACHINE CORPORATION, ERIE, PA.

Since 1919

SCRAPED SURFACE PLATES

MADE IN 24 DIFFERENT SIZES UP TO 36" x 60"

- Properly designed.
- Made from proven material, properly stabilized to prevent distortion and to outwear ordinary iron.
- Made to the most exacting standards that insure the highest degree of accuracy obtainable in any plate.
- More bearing per square inch for less cost.

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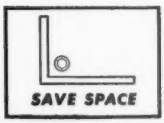
Yes, these screws save Time and Space!



No matter how close to a corner or flange you put Mac-it hexagon socket screws, there's plenty of room to drive them. Use this advantage to save space.

★ ★ ★

Mac-its are heat-treated to give far greater strength than plain steel screws. With that extra holding power, you may be able to use fewer screws—save drilling and tapping time.

OTHER MAC-IT PRODUCTS INCLUDE: Socket head and hexagon head cap screws, stripper bolts, hollow and square head set screws, hexagon socket pipe plugs.

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made to precision standards for instruments, dies and tools—specify GIBSON, product of 65 years specialized experience. Scientifically designed for the work they are to do, made to exact specifications, heat treated and thoroughly tested, they function more accurately, last longer, save time in assembly and adjustment, reduce spoilage, cut costs all around. Investigate! Write us about your requirements.

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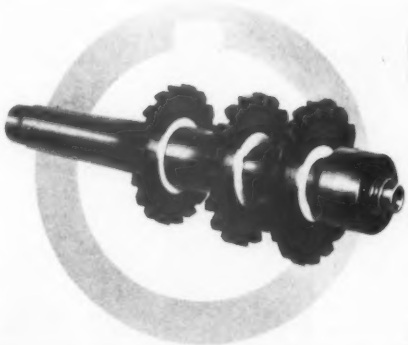
Plastics Milling Cutter Spacer Saves Metal



USERS of Artus milling cutter spacers, made of durable plastics, will be interested to know that a wider selection of stock sizes is now available. Thicknesses from .001-.030; hole diameters from ½" up to 4" and outer diameters from ⅞" up to 5" are immediately available. Each thickness has its own identifying color and any desired thickness can be readily selected without time-consuming micrometer-caliper measurements.

The spacers are said to be impervious to moisture and oil and to maintain their original thickness under all normal operating conditions. They permit the assembly of gangs of cutters or slitting saws or pairs of gears to accurate distances within 1/2000".

Further, being manufactured of plastics, they not only save valuable metals, but are obtainable when metals in special thicknesses are increasingly hard to get. Artus spacers are licensed and manufactured for the United States and Canada by Industrial Products Suppliers.

A leaflet, describing and illustrating the Artus spacers, is available from Industrial Products Suppliers, 2 Broadway, Dept. T, New York, N. Y. A list of users is included.

Don't miss the timely editorial, "Strategy for Peace," on page 67. Now is the time to plan for the peace after victory.

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PERISHABLE TOOLS

HILCO UNIVERSAL TOOL and CUTTER-GRINDER

Perishable tools — so difficult to obtain today — last longer, cut better and quicker if kept always sharp. The HILCO Universal Tool & Cutter-Grinder costs only $495.00 F.O.B. Chicago, complete with Universal Index Dividing Head, step collars, ¼ hp. 110 volt universal motor, index fingers, grinding wheels, etc. Quick delivery.

Write for circular and full specifications.

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Federal Taperlock

Plastic

GAGE HANDLES

IMMEDIATE DELIVERY

● Made of durable plastic material, they are lighter than any metal used for Gage Handles. This light weight makes gages more sensitive to touch and reduces fatigue caused by long continuous use, particularly in the case of women inspectors.

● Insulates from bodily heat, helping maintain accuracy of gages.

● Made to fit gages of standard sizes. Easily marked for identification with the same lettering stamps used for metal handles.

● Low cost represents a real saving. Available in 6 standard sizes, in any quantity and without delay.

● IN COLORS!! A new feature. Color permits quick identification of type or size without measuring. Furnished in RED—YELLOW—GREEN—BLACK.

FEDERAL TOOL CORP.
400 North Leavitt St.
CHICAGO

THE Special Tool, Die and Machine Shop Institute, Cleveland Chapter, held their Annual Dinner Dance February 6, 1943. A good time was had by all, according to John Fitzsimmons, Chairman of the Entertainment Committee.

We are proud to announce that out of their own pockets, the employees of Universal have bought and paid for a $50,000.00 U. S. fighter plane. And this, mind you, they have done in addition to pledging 20% for War Bonds.

We are proud too, of our Universal Drill Bushings which are straight and round, and have superfinished bores for accuracy and long life. Write today.

UNIVERSAL
ENGINEERING COMPANY
FRANKENMUTH, MICH.

TDM Industry Problems Discussed

(Continued from Page 100)

products classified broadly as 'tooling.'

"That brings you a responsibility none other than the maintenance of the highest standard of business. It means that your organization should include all industry members so that it speaks in your district for the whole industry. Your responsibility includes assistance to and direction of smaller shops in a cooperative way. Information for your members should include such new developments as the substitution of glass for steel in the manufacture of precision gages.

"To assure yourselves of such services, committees should think out and plan activities which will keep you as an industry in the forefront of developments. You may not be able to look into them all individually but you can collectively."

He then told of developments in the field of electronics, the possibilities of which are virtually limitless. The electronic tube, for instance, can see, hear, smell and taste with a degree of accuracy surpassing that of a human being. Many wartime applications have already been put to work, notably a detector which warns of the approach of enemy aircraft, records their exact location and directs the aim and fire of a gun in either darkness or daylight.

Mr. Huebner told the members of the Institute that "human relations" were daily becoming "a vitally important phase of operating a business." He said that the emphasis on obtaining more workers was shifting to more efficient management of those that industry already has. Job shifting, absenteeism, insubordination and quarrels between workers—these problems put a greater premium on the ability to handle employees successfully than on the skill of operating machines or fabricating materials. A good personnel man is worth many times his cost if he is skillful in dealing with human nature.

In conclusion, Mr. Huebner said: "Cooperation provides the method for successfully coping with the many problems which are bound to come up in our transition back to peacetime production."

MAKE-ALL RADIUS DRESSER

You will prefer the MAKE-ALL for simplified *Concave and Convex Radius Dressing* because it is so easy to operate. Feature of the Make-All is simplicity of design that results in an unusual degree of accuracy for a radius dresser requiring no difficult calculations, depth gauges, micrometer or vernier setting. Send priority rating with your order for prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

A special attachment accurately made, which with the use of Rattail Diamond Tools, will make full semi-circular radii as small as 0.035". Available at small additional cost.

$62.50 MAKE-ALL with one 60° GOLCONE Diamond Tool.

$72.50 MAKE-ALL with 60° GOLCONE, semi-circular radii attachment and Rattail Tool for 0.070" or larger radius.

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CERRO ALLOYS

SAVE TIME and CUT COSTS!

CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

CERROSAFE (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

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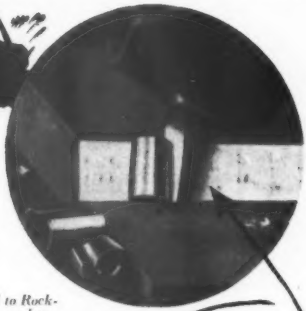

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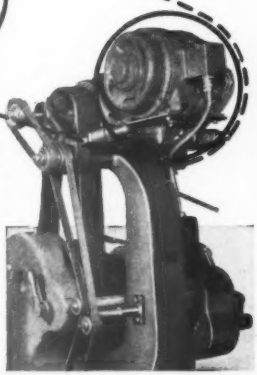

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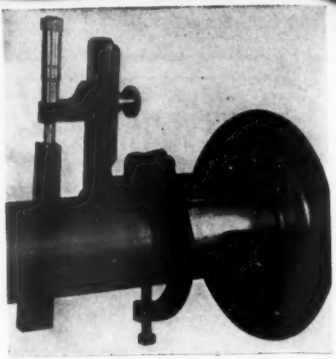

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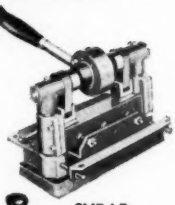

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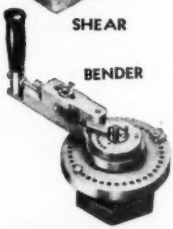

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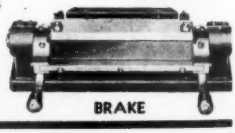

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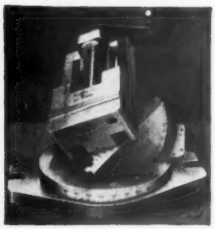

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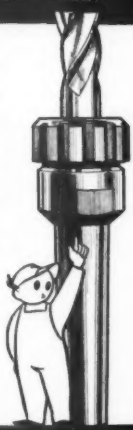

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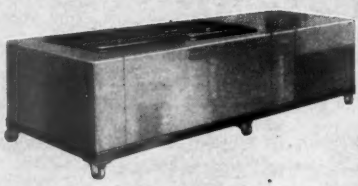

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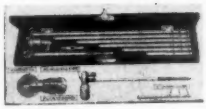

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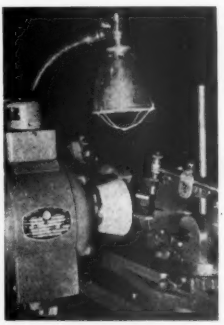

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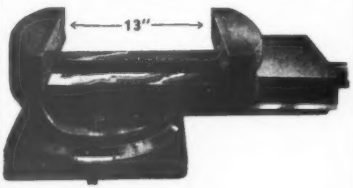

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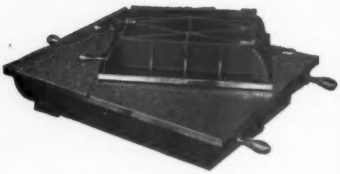

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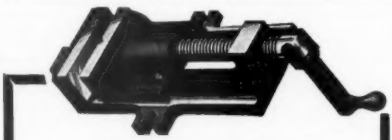

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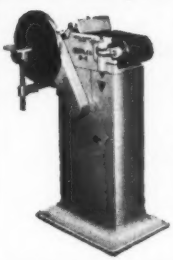

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Die Supply Co., 4751 Hough Ave., Cleveland, O.
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Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
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McKenna Metals Company, 500 Lloyd Ave., Latrobe, Pa.
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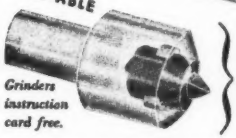

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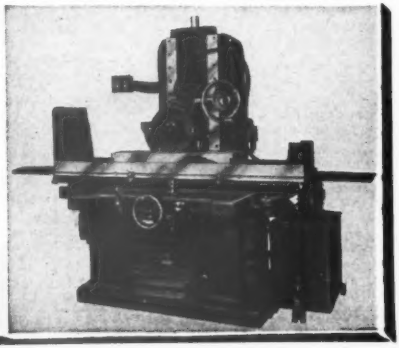

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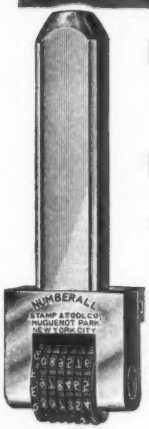

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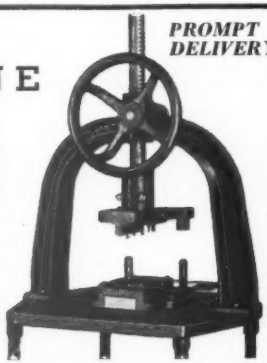

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Scherr Co., Inc., Geo., 128-B Lafayette St., New York, New York
Tools & Gages, Inc., 3112 E. 63 St., Cleveland, O.
Turner Gauge Grinding Co., 2624 Hilton Rd., Detroit, Mich.
United Precision Products Co., 3516 W. Belmont Ave., Chicago, Ill.
Vickers Broach & Gage Co., 1009-15 Franklin St., Detroit, Mich.

GAGES—Precision
Pal Tool Company, 2300 East 31 St., Minneapolis, Minn.
Perfex Gage & Tool Co., 3604 Gaylord, Detroit, Mich.
Pipe Machinery Co., The, Cleveland, Ohio
Tools & Gages, Inc., 3112 E. 63rd St., Cleveland, O.
Turner Gauge Grinding Co., 2624 Hilton Rd., Detroit, Mich.
Vickers Broach & Gage Co., 1009-15 Franklin St., Detroit, Mich.

GAGES—Snap
Lauer Tool & Gauge Co., 14265 Birwood, Detroit, Mich.
Perfex Gage & Tool Co., 3604 Gaylord, Detroit, Mich.
Tools & Gages, Inc., 3112 E. 63 St., Cleveland, O.
Turner Gage Grinding Co., 2624 Hilton Rd., Detroit, Mich.

GAGES—Thread
Federal Products Corp., 1 Reservoir St., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Perfex Gage & Tool Co., 3604 Gaylord, Detroit, Mich.
Scherr Co., Inc., Geo., 128-B Lafayette St., New York, New York
Sossner, 161 Grand St., New York, N. Y.
Starrett Co., L. S., Athol, Mass.
Tools & Gages, Inc., 3112 E. 63 St., Cleveland, O.

GAGES—Tool Setting
Bartelt Engineering Co., 1214 Partridge Ave., Beloit, Wisc.
Tools & Gages, Inc., 3112 E. 63 St., Cleveland, Ohio
Vickers Broach & Gage Co., 1009-15 Franklin St., Detroit, Mich.

GEARS—Special
Taylor Machine Co., 1917 E. 61st, Cleveland, O.

GRINDERS—Abrasive Band and Disk
Walls Sales Corp., 97 Warren St., New York, N. Y.

GRINDERS—Air
Madison-Kipp Corp., 212 Waubesa St., Madison, Wisc.

GRINDERS—Carbide
Baldor Electric Co., 4305 Duncan Ave., St. Louis, Mo.
Delta Mfg. Co., 612-B East Vienna Ave., Milwaukee, Wis.
Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich.

GRINDERS—Cutter & Tool
Boyar-Schultz Corp., 2112-A Walnut St., Chicago, Ill.
Covel Mfg. Co., Benton Harbor, Mich.
Douglas Machinery Co., 150 Broadway, New York, N. Y.
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Norton Company, Worcester, Mass.
Oliver Instrument Co., 1436 Maumee St., E., Adrian, Mich.
Scherr Co., Inc., Geo., 128-B Lafayette St., New York, New York
Thompson Grinder Co., Springfield, O.

GRINDERS—Cylindrical
Norton Company, Worcester, Mass.

GRINDERS—Face
Bridgeport Safety Emery Wheel Co., 1301 W. Broad St., Bridgeport, Conn.

GRINDERS—Hand
Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Dept. TD, Chicago, Ill.
Dumore Company, Dept. 373-A, Racine, Wis.
Duro Metal Products Co., 2653 N. Kildare Ave., Chicago, Ill.
Foredom Elec. Co., 27 Park Place, New York, N. Y.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.

GRINDERS—Hydraulic Feed
Gallmeyer & Livingston Co., 304 Straight Ave., S.W., Grand Rapids, Mich.

GRINDERS—Internal
Leach Machinery Co., H., 385 Charles St., Providence, R. I.
Majestic Tool & Mfg. Co., 2946 Woodbridge St., E., Detroit, Mich.
Sav-Way Industries, 4875 E. 8 Mile Rd., Detroit, Mich.

GRINDERS—Portable
Dumore Co., Dept. 373-A, Racine, Wis.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.

GRINDERS—Precision for Contours
Baker Brothers, Inc., Toledo, O.
Boyar-Schultz Corp., 2112-A Walnut St., Chicago, Ill.
Savage Tool Company, Dept. TD, Savage, Minn.

GRINDERS—Surface
Abrasive Machine Tool Co., E. Providence, R. I.
Atlantic Machinery Corp., 149 Broadway, New York, N. Y.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., 304 Straight Ave., S.W., Grand Rapids, Mich.
Hammond Machy. Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich.
Norton Company, Worcester, Mass.
Portman Machine Tool Co., 17 Beechwood Ave., Mt. Vernon, N. Y.
Savage Tool Co., Dept. TD., Savage, Minn.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.

GRINDERS—Swing Lathe
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.

GRINDERS—Universal
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., 304 Straight Ave., Grand Rapids, Mich.
Norton Company, Worcester, Mass.

GRINDERS—Utility
M-B Products, 130 E. Larned St., Detroit, Mich.

GRINDER CENTERS
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

GRINDER TOOLS
Norton Company, Worcester, Mass.

GRINDING MACHINES—Tap
Oliver Instrument Co., 1436 Maumee St., E., Adrian, Mich.

GRINDING & LAPPING—Precision
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.

GRINDING WHEELS
Carborundum Company, The, Niagara Falls, N. Y.
De Sanno & Son, Inc., A. P., Phoenixville, Pa
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.
Norton Company, Worcester, Mass.

GUIDE PINS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.

HAMMERS & MALLETS—Rawhide
Chicago Rawhide Mfg. Co., 1280 Elston Ave., Chicago, Ill.
Victory Safety Hammer Corp., East Orange, N. J.

HAMMERS—Steam Drop
Chambersburg Engineering Co., Chambersburg, Pa.

HAND TAPPERS
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

HARDNESS TESTERS
Shore Instrument & Mfg. Co., Inc., The, 9035 Van Wyck Ave., Jamaica, N. Y.

HOBS
Pipe Machinery Co., The, Cleveland, O.

HOISTS
American MonoRail Co., 13131 Athens Ave., Cleveland, Ohio

HOLDERS—Indicator
Oslund Tool & Die Co., 14 Sigourney St., Hartford, Conn.

HOLDERS—Tap
Alco Tool Co., The, 552 Birdseye St., Bridgeport, Conn.
Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill.

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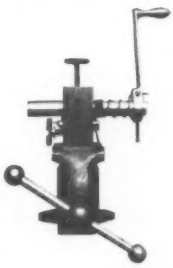

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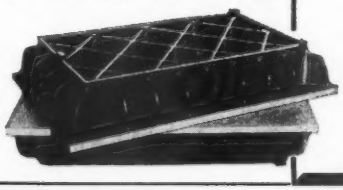

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Gairing Tool Co., Roosevelt Park Annex, Detroit, Mich.

HONING MACHINES—Horizontal
Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit, Mich.
Sunnen Products Co., 7947 Manchester Ave., St. Louis, Mo.

INDICATORS
Lufkin Rule Co., Saginaw, Mich.
Oslund Tool & Die Co., 14 Sigourney St., Hartford, Conn.

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Federal Products Corp., 1 Reservoir St., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

INDICATORS—Test
Koch Test Indicator, 28 Second Ave., Nyack, N. Y.
Starrett Co., L. S., Athol, Mass.

INDEXING DEVICES
Cleveland Tool Engineering Co., 9105 Detroit Ave., Cleveland, O.
Hardinge Brothers, Inc., Elmira, N. Y.
Hartford Special Machy. Co., 281 Homestead Ave., Hartford, Conn.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Zagar Tool, Inc., 23881 Lakeland Blvd., Cleveland, O.

INDUSTRIAL LIGHTING — Equipment
Vimco Mfg. Co., 117 Chenango St., Buffalo, N. Y.

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Brush Development Co., The, 3311 Perkins Ave., Cleveland, O.

JACKS—Machine
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DeVlieg Machine Co., 450 Fair Ave., Ferndale, Mich.
Marburg Bros., Inc., 88-92 West St., New York, N. Y.
Moore Special Tool Co., Inc., Bridgeport, Conn.

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Moore Special Tool Co., Inc., Bridge-Port, Conn.

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Master Machine & Tool Co., 925 W. North Ave., Chicago, Ill.

KEYS—Socket Screw
Holo-Krome Screw Corp., Hartford, Conn.

LAPS—Copper Head Expansion
Boyar-Schultz Corp., 2112-A Walnut St., Chicago, Ill.

LAPPING—Contrast
Acme Industrial Co., 206 N. Laflin St., Chicago, Ill.
Ultra Lap Machine Co., 254 McDougall Ave., Detroit, Mich.

LAPPING COMPOUND
Carborundum Company, The, Niagara Falls, N. Y.

LAPPING MACHINES
Norton Company, Worcester, Mass.
Schraner & Co., A. P., 3338 Payne Ave., Cleveland, O.
Ultra Lap Machine Co., 254 McDougall Ave., Detroit, Mich.

LAPPING PLATES
Smith Tool & Engrg. Co., 818 N. Wingert St., Bucyrus, Ohio.

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McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

LATHE DOGS
Armstrong Bros. Tool Co., 340 N. Francisco Ave., Chicago, Ill.

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Lima Electric Motor Co., Lima, O.

LATHES—Precision Plain Type
Hardinge Brothers, Inc., Elmira, N. Y.

LATHES — Precision Screw Cutting Type
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LATHES—Speed
Schauer Machine Co., 2076 Reading Rd., Cincinnati, O.

LATHES—Toolroom
Atlas Press Co., 212 N. Pitcher St., Kalamazoo, Mich.
Monarch Machine Tool Co., The, Sidney, O.
Sebastian Lathe Co., P. O. Box 1017E, Cincinnati, O.
Sheldon Machine Co., Inc., 4236 No. Knox Ave., Chicago, Ill.
South Bend Lathe Works, South Bend, Ind.

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Dykem Co., 2201 No. 11 St., St. Louis, Mo.
Michigan Chrome and Chemical Co., 6350 E. Jefferson Ave., Detroit, Mich.
Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill.

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Die Supply Co., 4751 Hough Ave., Cleveland, O.

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Economy Engineering Co., 2659 W. Van Buren St., Chicago, Ill.

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MACHINE VISES
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Producto Machine Co., The, 990 Housatonic Ave., Bridgeport, Conn.

MARKING DEVICES
AcromarK Company, The, 5-15 Morrell St., Elizabeth, N. J.
Cunningham Co., M. E., 104 E. Carson St., Pittsburgh, Pa.

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O'Neil-Irwin Mfg. Co., 315 8th Ave., So., Minneapolis, Minn.

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Federal Products Corp., 1 Reservoir St., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., George, 128-B Lafayette St., New York, N. Y.
Starrett Co., L. S., Athol, Mass.

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Gairing Tool Co., The, Roosevelt Park Annex, Detroit, Mich.
Galter Manufacturing Co., 711 W. Lake St., Chicago, Ill.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.
Putnam Tool Co., 2985 Charlevoix, Detroit, Mich.
Severance Tool Co., 1506 E. Genesee Ave., Saginaw, Mich.
Tomkins-Johnson Co., 630 N. Mechanic St., Jackson, Mich.

MILLING FIXTURES
Auto-Ordnance Corp., 342 W. Putnam Ave., Bridgeport, Conn.

MILLING MACHINES—Attachments
Ajax Engineering & Manufacturing Co., 14230 Birwood, Detroit, Mich.
Auto-Ordnance Corp., 1437 Railroad Ave., Bridgeport, Conn.
Burke Machine Tool Co., 301 E. 16th St., Conneaut, O.
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Kearney & Trecker Products Corp., West Allis Station, Milwaukee, Wis.
Van Norman Machine Tool Co., Springfield, Mass.

MILLING MACHINES—Continuous
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, O.

MILLING MACHINES—Dial Type
Cincinnati Milling Machine Co., Cincinnati, O.

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Burke Machine Tool Co., 301 E. 16th St., Conneaut, O.
Douglas Machy. Co., 150 Broadway, New York, N. Y.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Lucas & Sons, Inc., J. L., Bridgeport, Conn.
Machinery Manufacturing Co., 1915 E. 51 St., Vernon, Los Angeles, Cal.
Van Norman Machine Tool Co., Springfield, Mass.

MILLING MACHINES—Precision
Blank & Buxton Machine Co., 3110 E. Michigan Ave., Jackson, Mich.
Burke Machine Tool Co., 301 E. 16th St., Conneaut, O.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.

MILLING MACHINES — Precision Horizontal Floor Types
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Kempsmith Machine Co., Milwaukee, Wis.

MILLING MACHINES—Vertical
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
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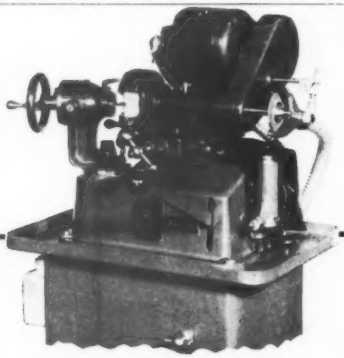

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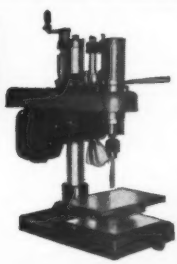

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Numberall Stamp & Tool Co., Huguenot Park, Staten Island, N. Y.

OVENS—Industrial
Despatch Oven Co., 600 S.E. Ninth St., Minneapolis, Minn.
Johnson Gas Appliance Co., 560 E Ave., N.W., Cedar Rapids, Ia.

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Busch Company, J. C., 172 S. Ferry St., Milwaukee, Wis.
Challenge Machinery Co., Grand Haven, Mich.
Delta Mfg. Co., 612-B East Vienna Ave., Milwaukee, Wis.
Smith Tool & Engrg. Co., 818 N. Wingert St., Bucyrus, O.
Tool Engineering Service Co., Inc., 245 Washington Ave., Nutley, N. J.

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Wilson, K. R., 10 Lock St., Buffalo, N. Y.

PRESSES—Drill
Delta Mfg. Co., 612-B East Vienna Ave., Milwaukee, Wis.
Duro Metal Products Co., 2653 N. Kildare Ave., Chicago, Ill.

PRESSES—Electric
Lempco Products, Inc., Dept. TD, Bedford, O.

PRESSES—Hand Punch
Leslie Welding Co., 2941 Carroll Ave., Chicago, Ill.

PRESSES—Utility
Producto Machine Co., The, 990 Housatonic Ave., Bridgeport, Conn.

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Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.

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Eastern Engineering Co., 72 Fox St., New Haven, Conn.
Ruthman Machinery Co., 1813 Reading Rd., Cincinnati, O.

PUMPS—Hydraulic
Racine Tool and Machine Co., 1768 State St., Racine, Wis.

PUNCH PRESS
Di Machine Corp., 3653 Lincoln Ave., Chicago, Ill.

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Knu-Vise, Incorporated, 1332 Plum St., Detroit, Mich.

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Hovis Screwlock Co., 8100 E. Nine Mile Road, Van Dyke, Mich.
Strippit Corporation, The, N. Tonawanda, N. Y.

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Putnam Tool Co., 2985 Charlevoix Ave., Detroit, Mich.

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Evans Flexible Reamer Co., 4543 Ravenswood Ave., Chicago, Ill.

REAMERS—Self-centering Cylinder
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Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.
Walls Sales Corp., 97 Warren St. New York, N. Y.

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Duro Metal Products Co., 2653 N. Kildare Ave., Chicago, Ill.

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Industrial Eng. Co., Inc., 141 W. Jackson Blvd., Chicago, Ill.

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SAWING MACHINES—Continuous
Continental Machines, Inc., 1303 So. Washington St., Minneapolis, Minn.

SAWING MACHINES—Metal
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Peerless Machine Co., Dept. TDJ-542, Racine, Wis.
Racine Tool & Machine Co., 1768 State St., Racine, Wis.

SAWS—Portable
Skilsaw, Inc., 5061 Elston Ave., Chicago, Ill.

SAWS—Hack
Sales Service & Mfg. Co., 473 N. Cleveland Ave., St. Paul, Minn.

SAWS—Hydraulic
Peerless Machine Co., Dept. TDJ-542, Racine, Wis.
Racine Tool & Machine Co., 1768 State St., Racine, Wis.

SAWS—Swiss Piercing
Bollag, Max, 77 Wall St., New York, N. Y.

SCREW MACHINE PARTS—Precision
Smillie & Co., C. M., 1108 Woodward Hgts., Ferndale, Mich.

SCREW MACHINE PRODUCTS—Contract
Star Machine & Tool Co., 9320 Woodland Ave., Cleveland, O.

SCREW MACHINE PRODUCTS—Hardened & Ground
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.

SCREW MACHINES—Hand
Logan Engineering Co., Chicago, Ill.

SCREW MACHINES—Precision Bench Type
Hardinge Brothers, Inc., Elmira, N. Y.

SCREWS—Socket Head
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit, Mich.
Die Supply Co., 4751 Hough Ave., Cleveland, O.
Holo-Krome Screw Corp., Hartford, Conn.
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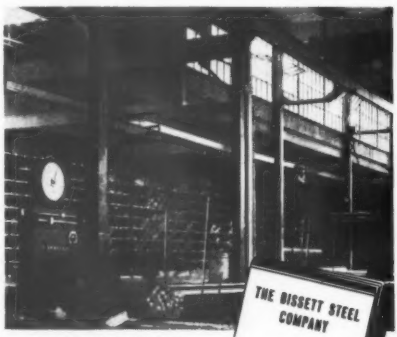

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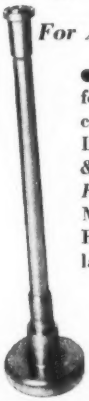

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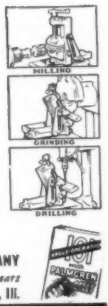

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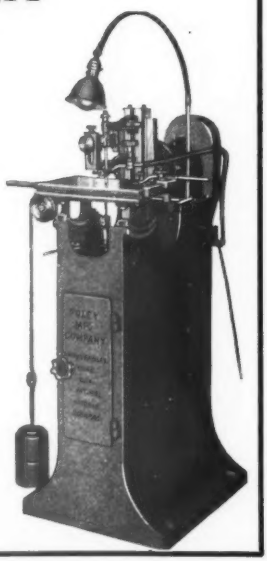

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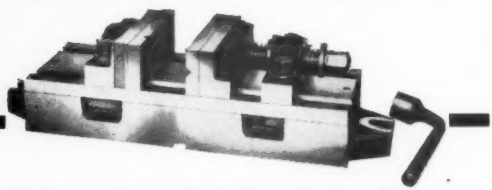

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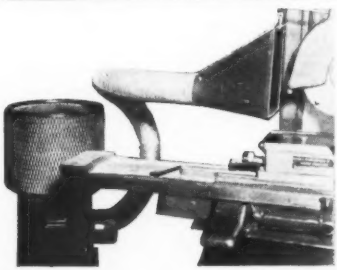

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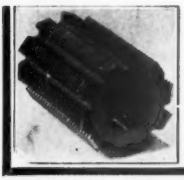

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(Continued from Page 221)

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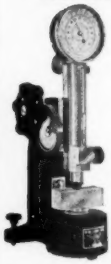

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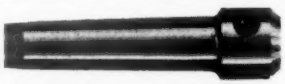

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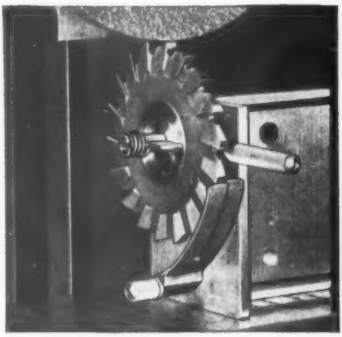

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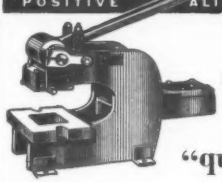

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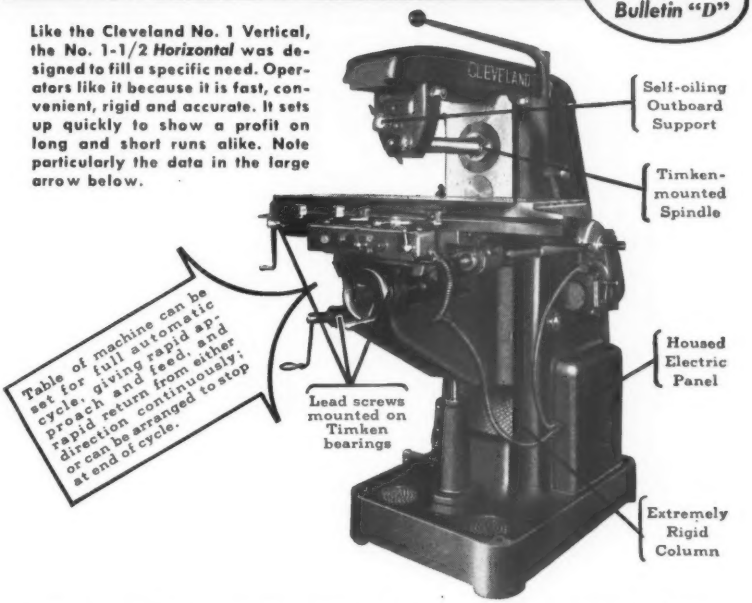
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